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(52) UK CL (Edition K)
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B8D D65B5B DFD

(56) Documents cited
GB 2219570 A GB 2158424 A GB 2136408 A
EP 0014319 A US 4497415 A

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INT CL[5] B65D

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(54) Tamper-evident closure

(57) A closure of thermoplastics materials, for a bottle or similar container includes means P by which it is evident whether the closure has been opened since first being fitted to a bottle. The closure may optionally also include means C preventing the bottle from being refilled with liquid after the closure is first fitted. The closure comprises a retaining tube E adapted to fit and be retained around the neck of a bottle F; a seal member D which fits into the opening in the bottle F and forms a seal with it; a pouring member N which provides a pouring orifice and which seals against the seal member D and is connected to the retaining tube E; and a screw cap M which fits onto the pouring member N. The tamper-evident means comprise a ring P having frangible portions which are either broken when the closure is first assembled (Fig 32–35), or which are broken when the closure is first removed from the bottle F (Fig 17). The non-refilling mechanism may comprise a gravity valve member C which co-operates with a valve seat on the seal member D and is pressed into position by a depending centre rod on the cap (10–12, Fig 3). The retaining tube E may be adapted to fit a conventional bottle. In use, the assembled closure is fitted on the neck of the bottle by means of vertical pressure, lugs, ridges projections and cavities co-operating to prevent relative rotation of the tube, seal member and pouring member. The tamper evident means may comprise a separate frangible strip located between the cap and retaining tube (Fig 30), and the pouring member may have a curved outlet to prevent drips (Fig 5).

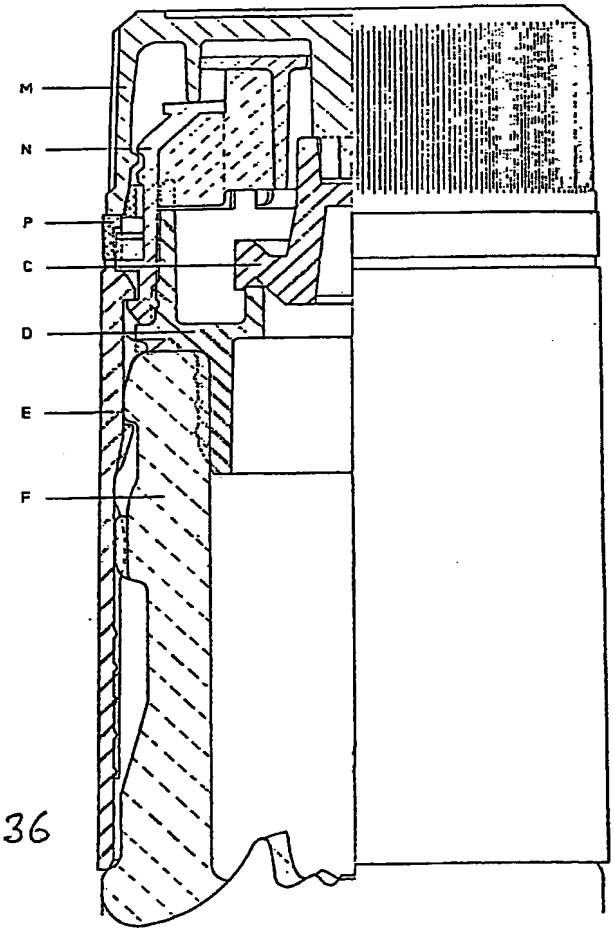

FIG 36

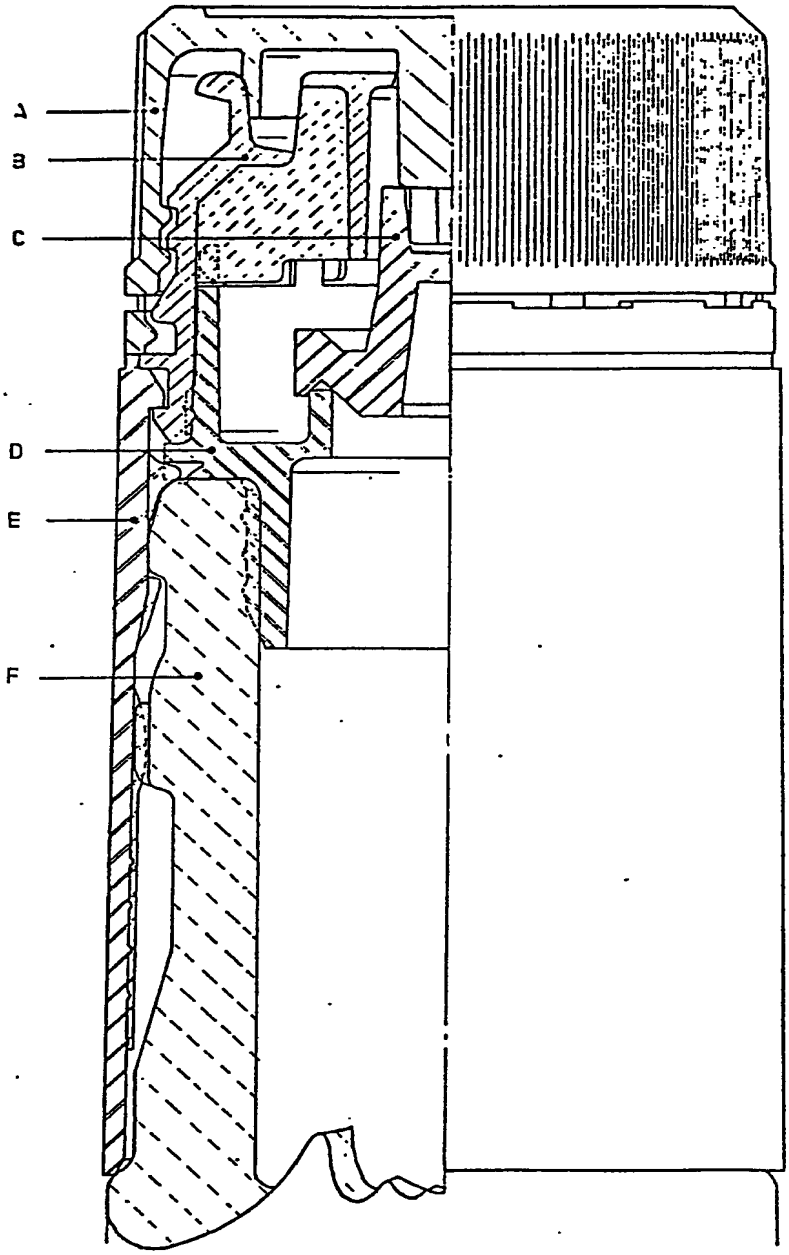

FIG 1

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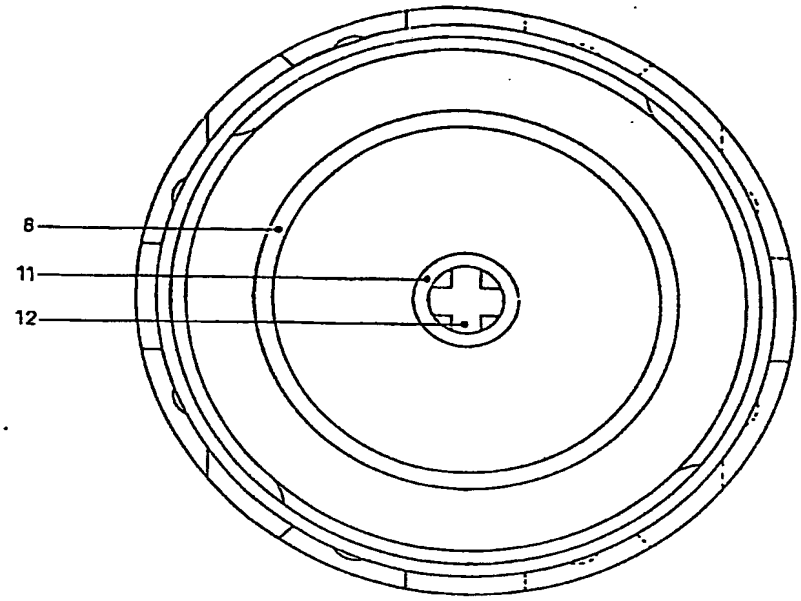

FIG 2

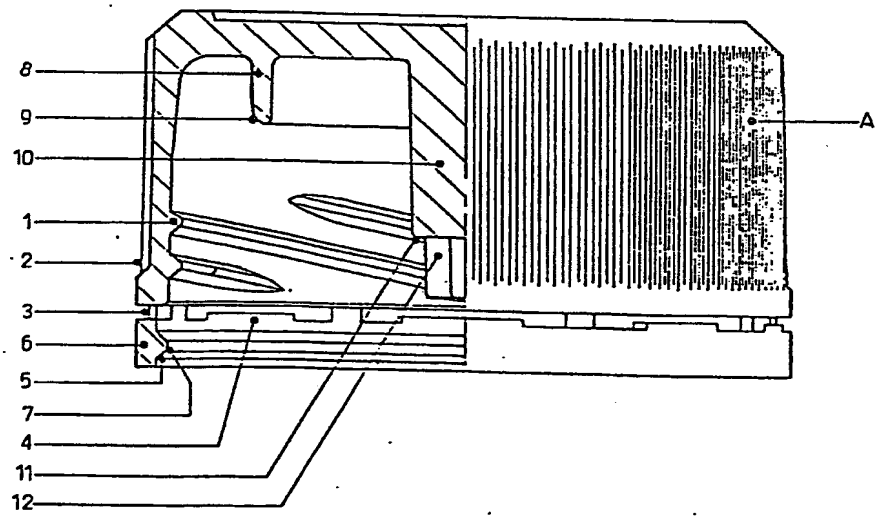

FIG 3

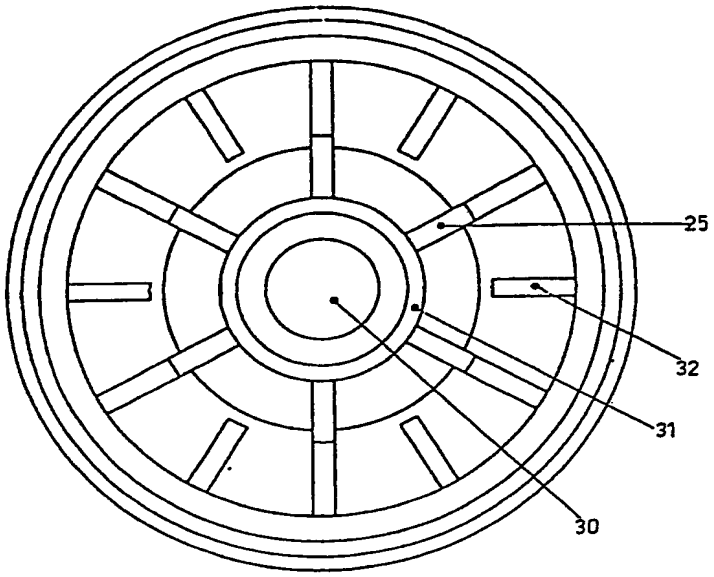

FIG 4

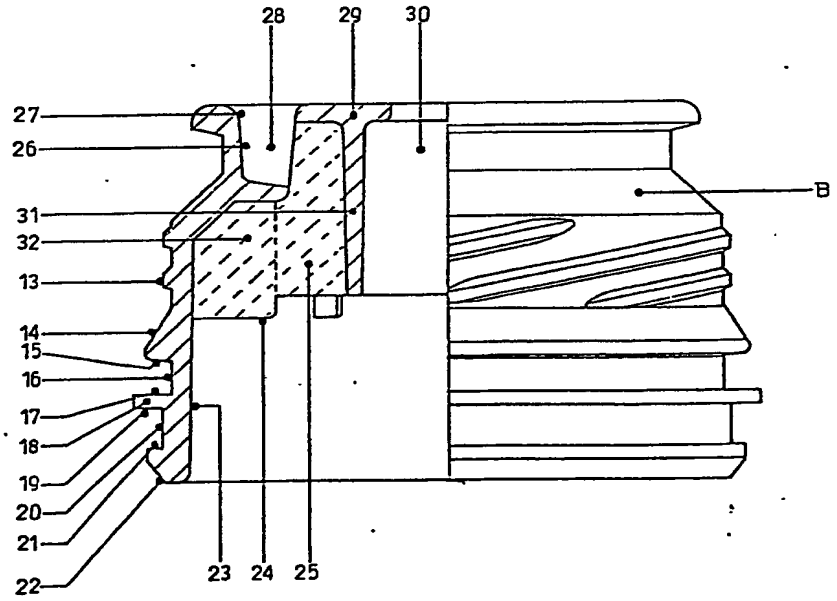

FIG 5

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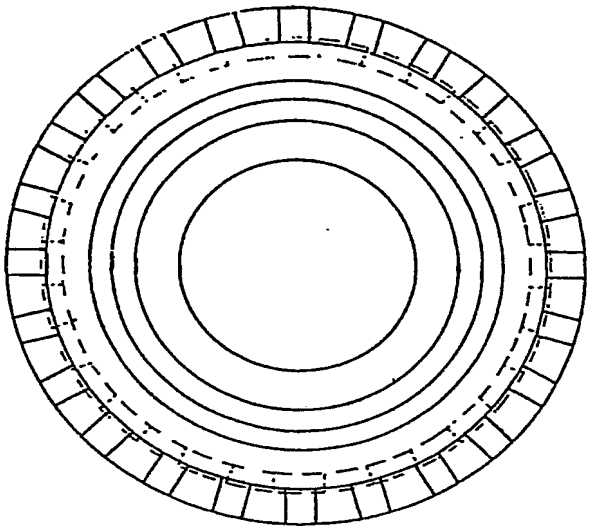

FIG 6

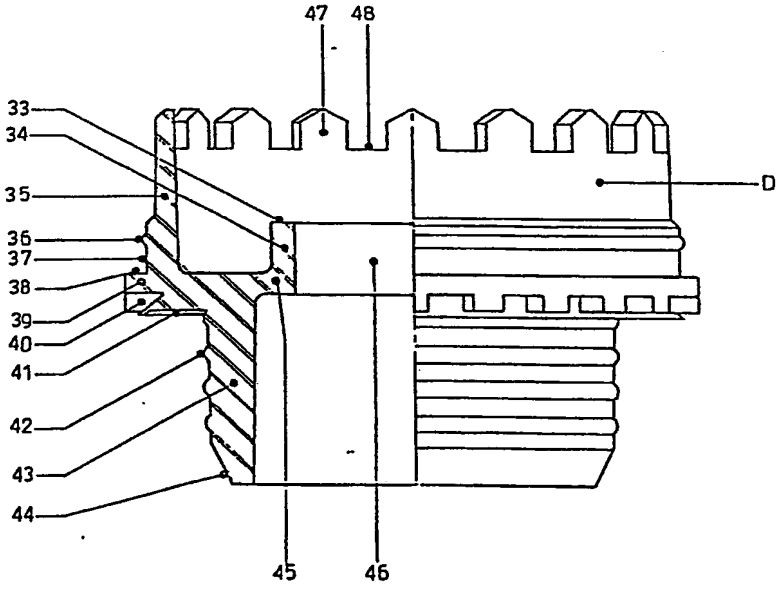

FIG 7.

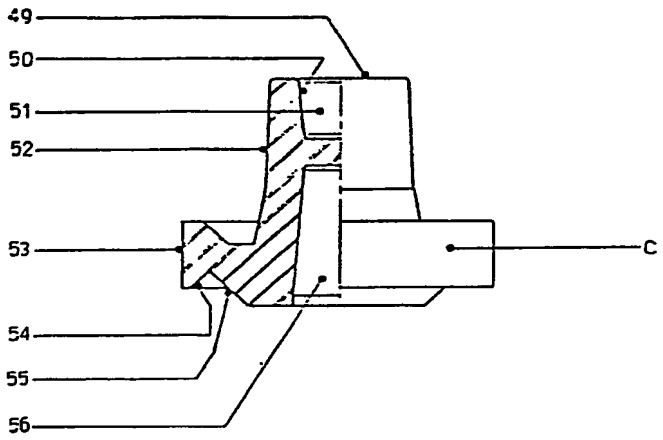

FIG 8

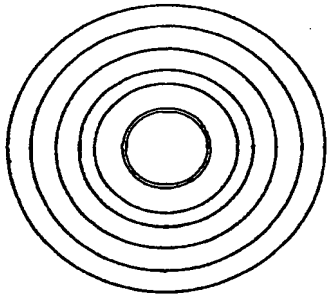

FIG 9

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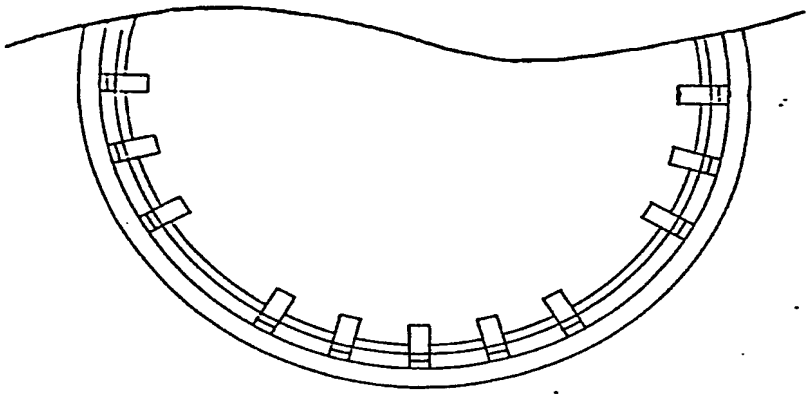

FIG 10

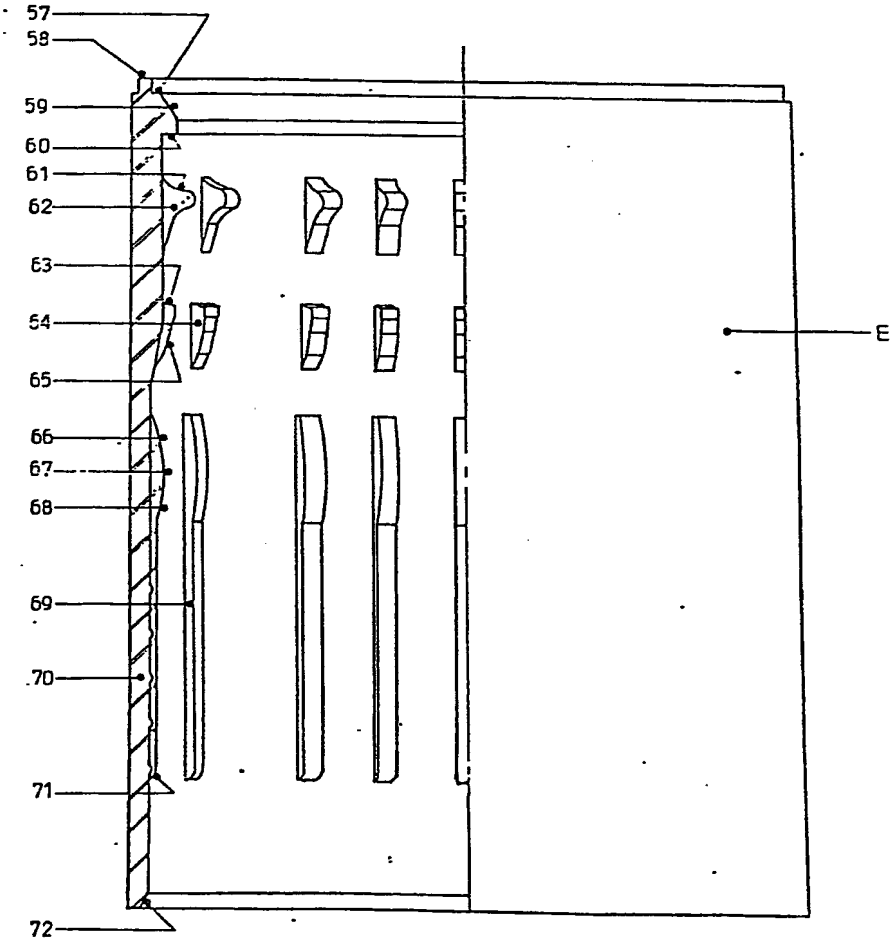

FIG 11

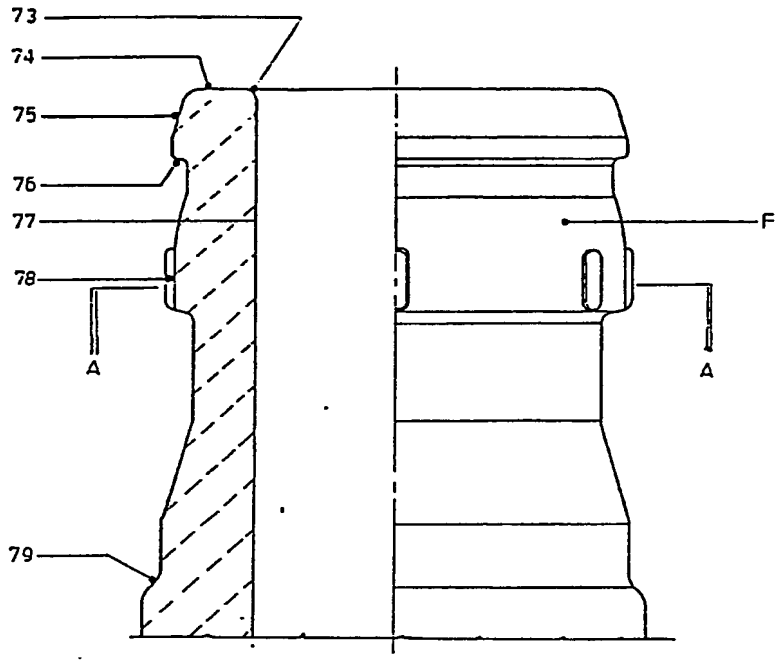

FIG 12

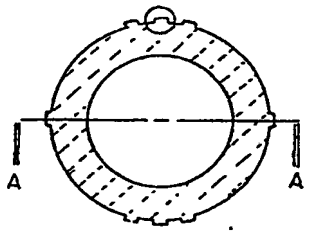

FIG 13

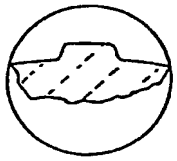

FIG 14

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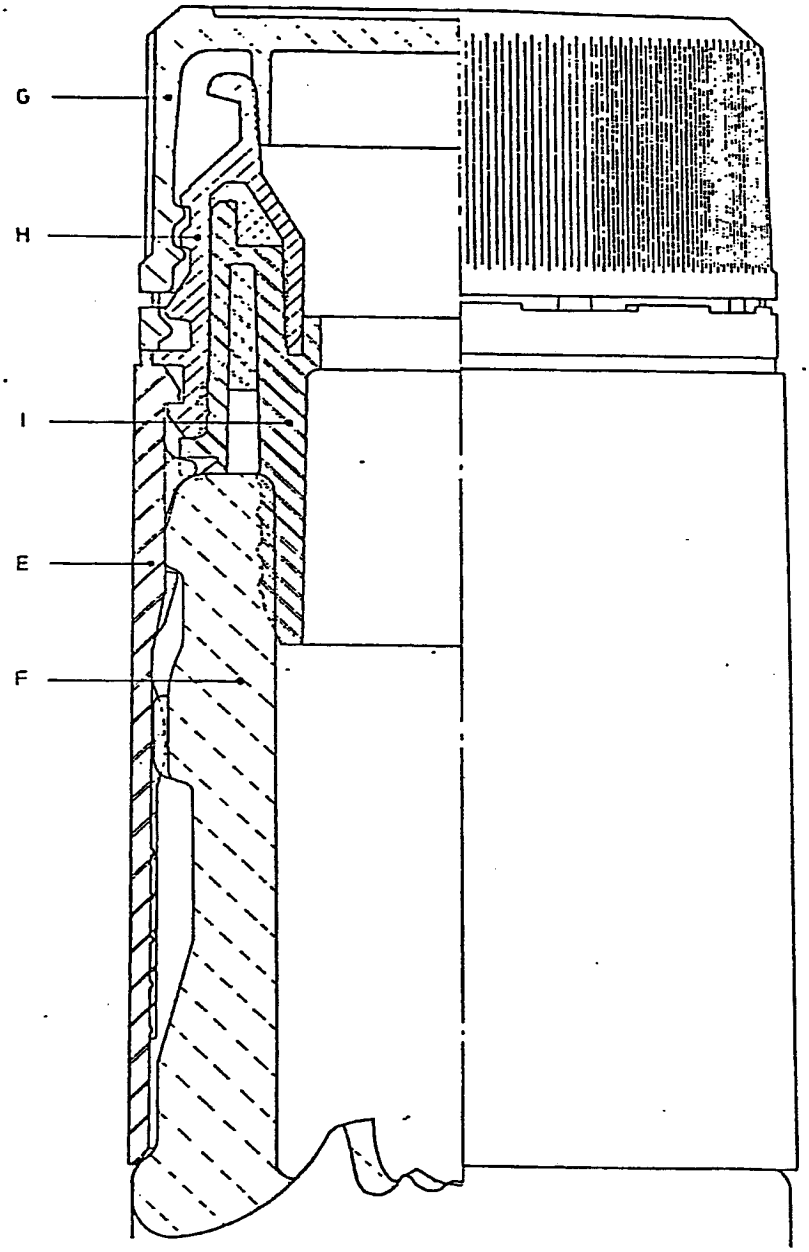

FIG 15

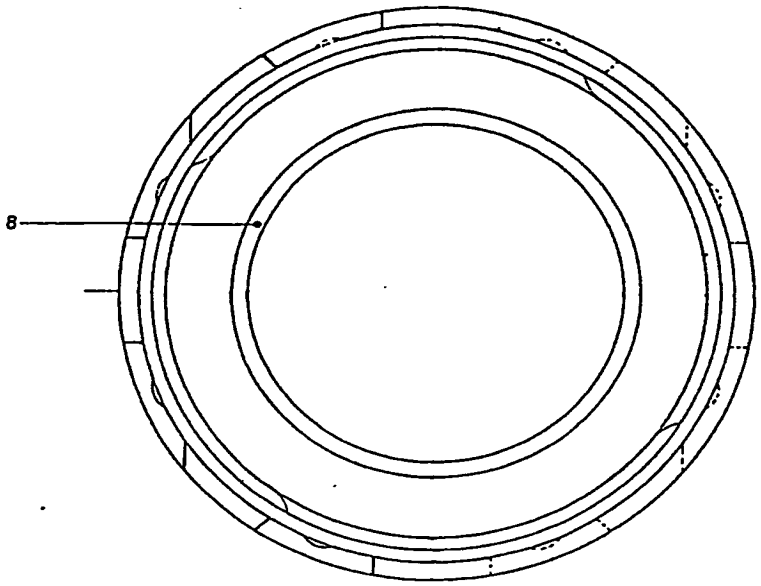

FIG 16

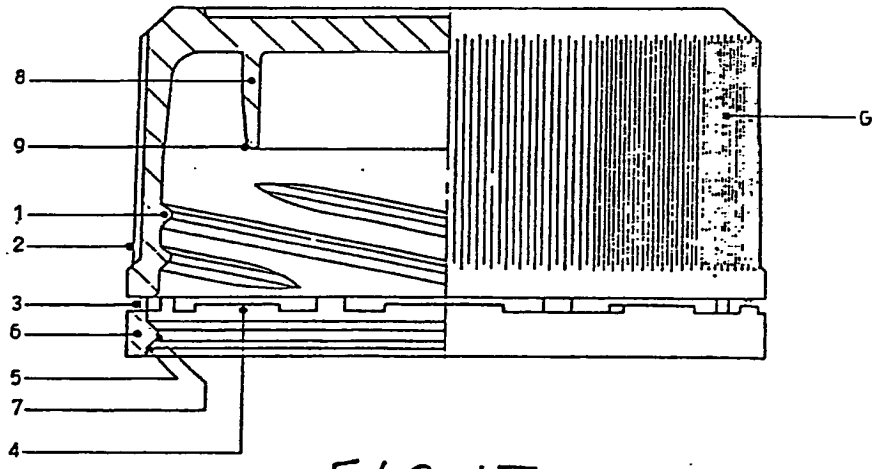

FIG 17

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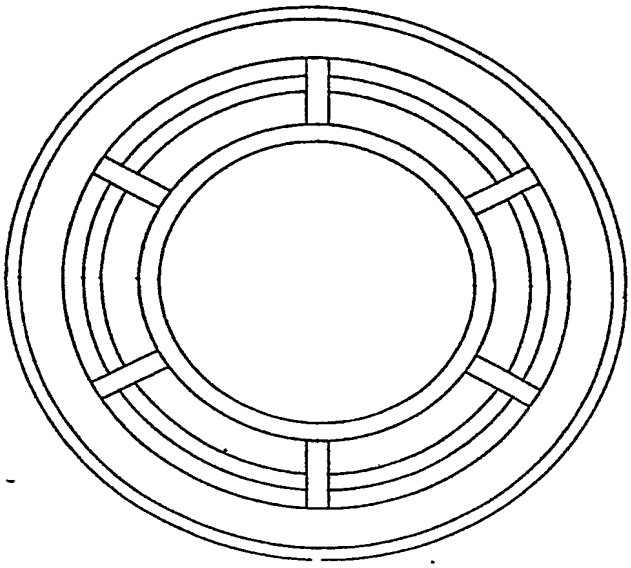

FIG 18

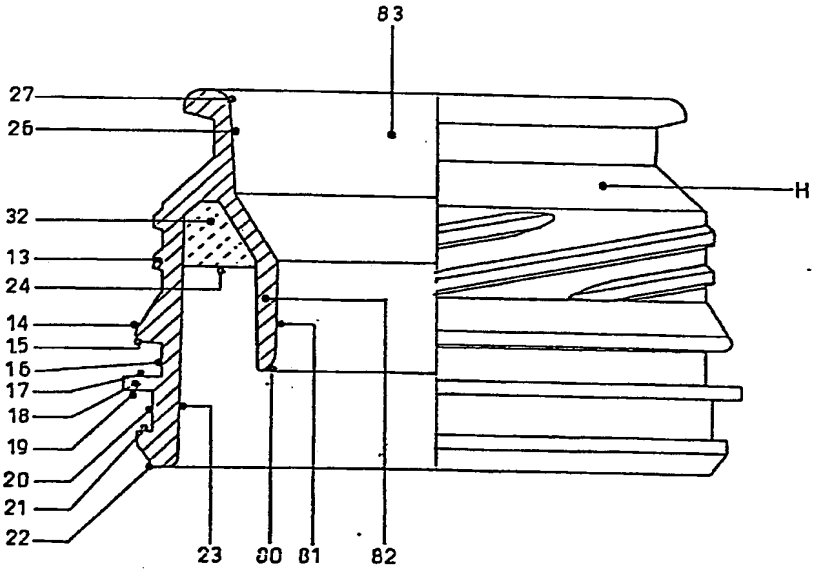

FIG 19

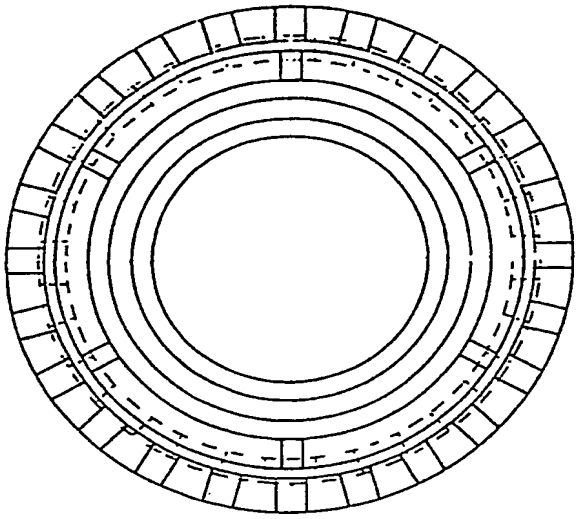

FIG 20

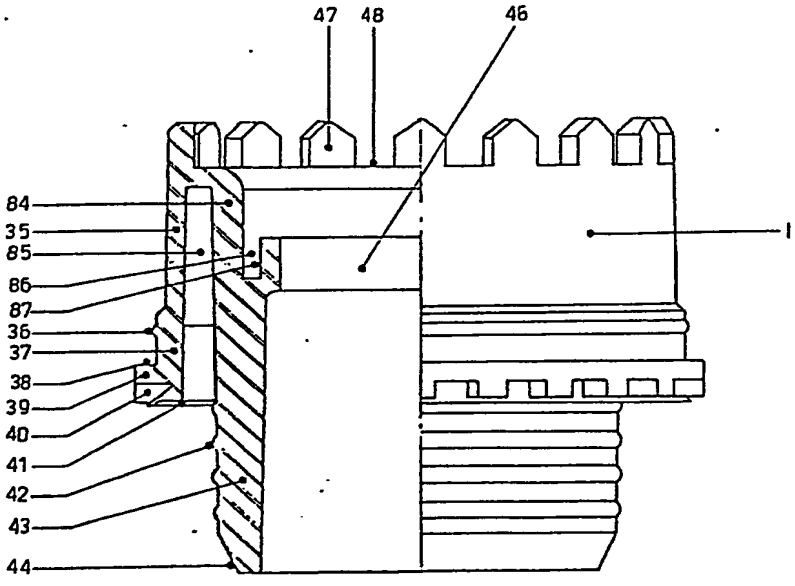

FIG 21

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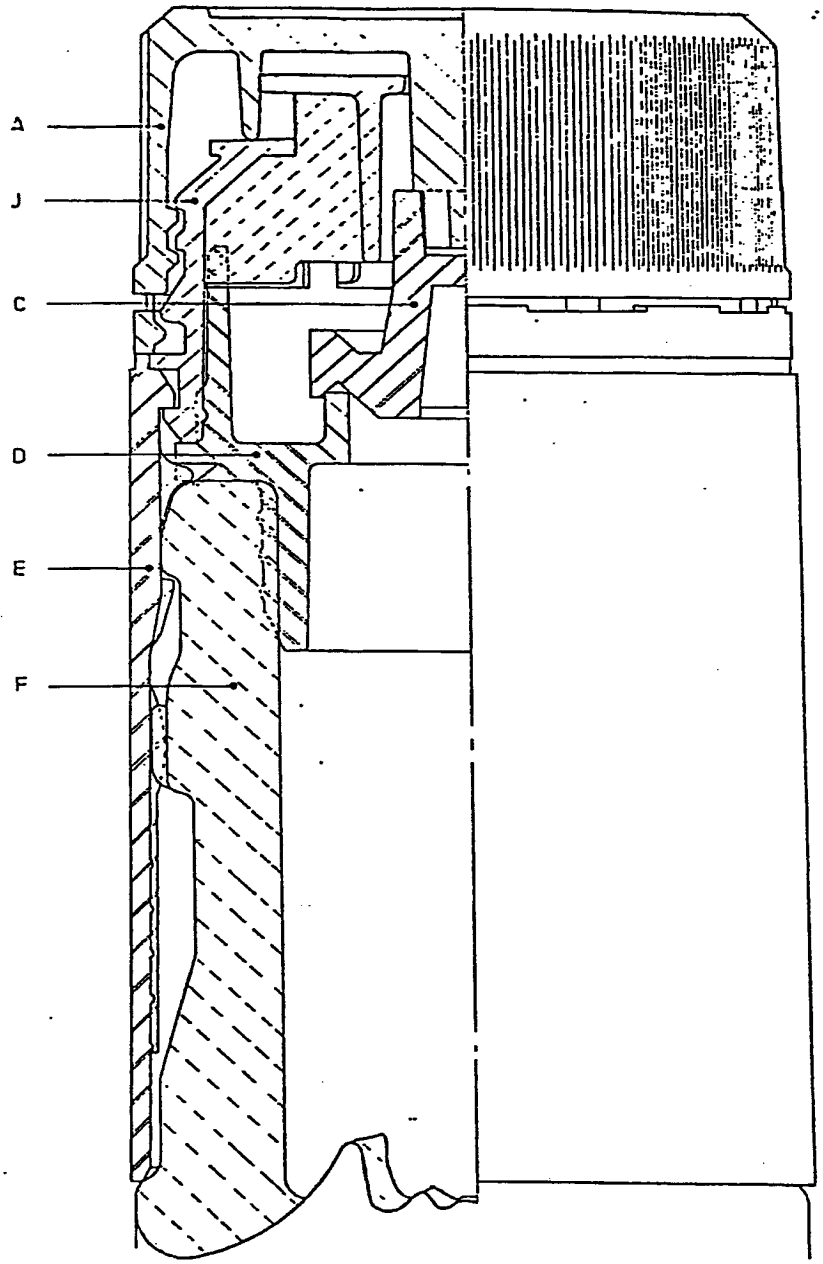

FIG 22

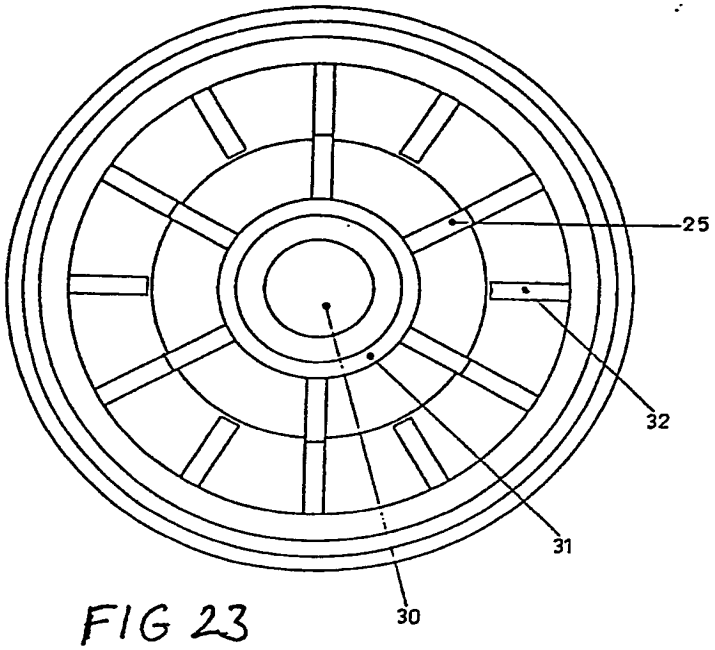

FIG 23

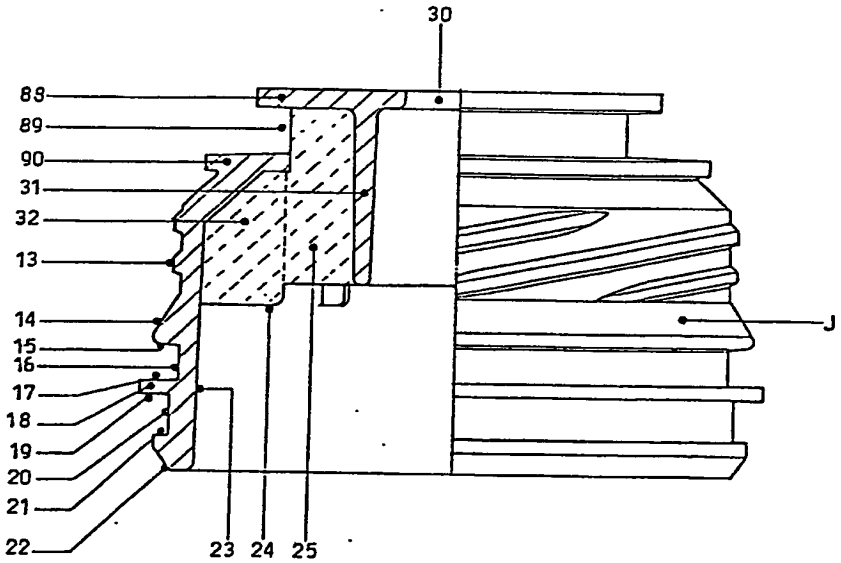

FIG 24

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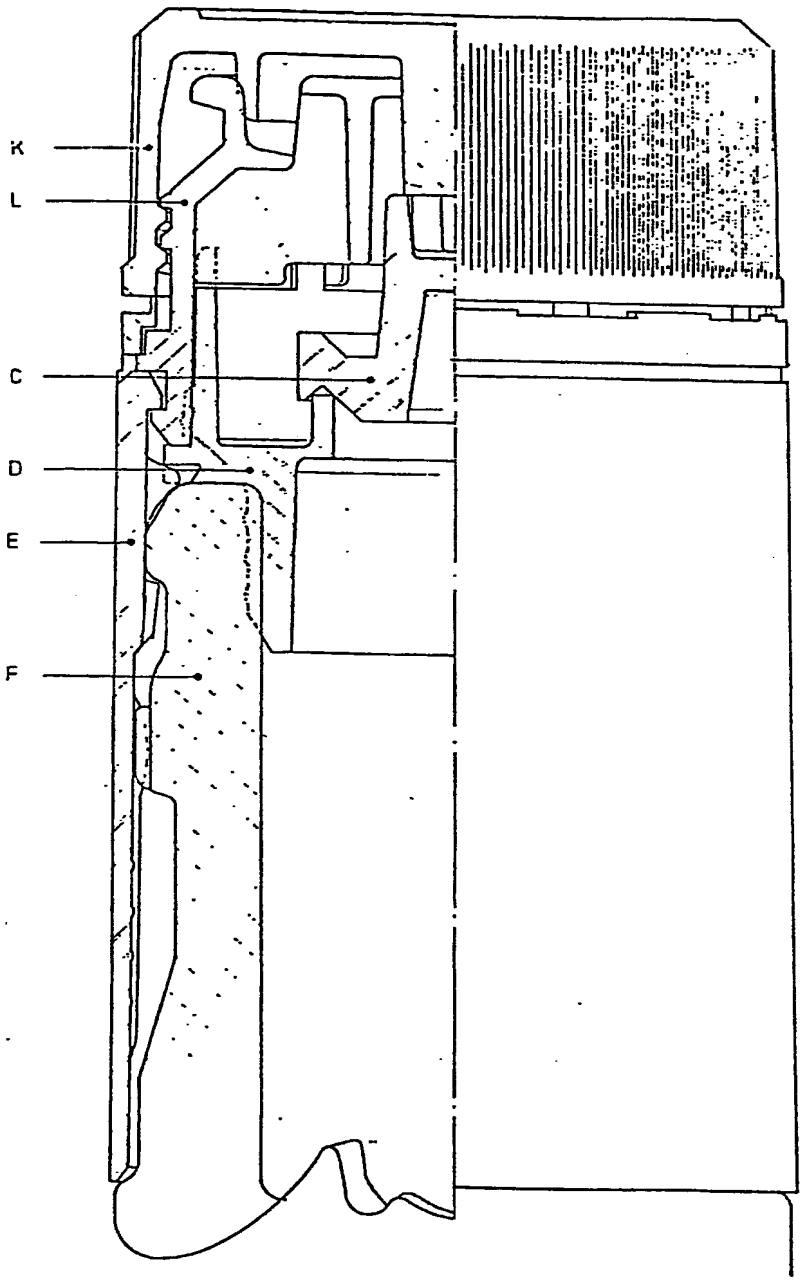

FIG 25

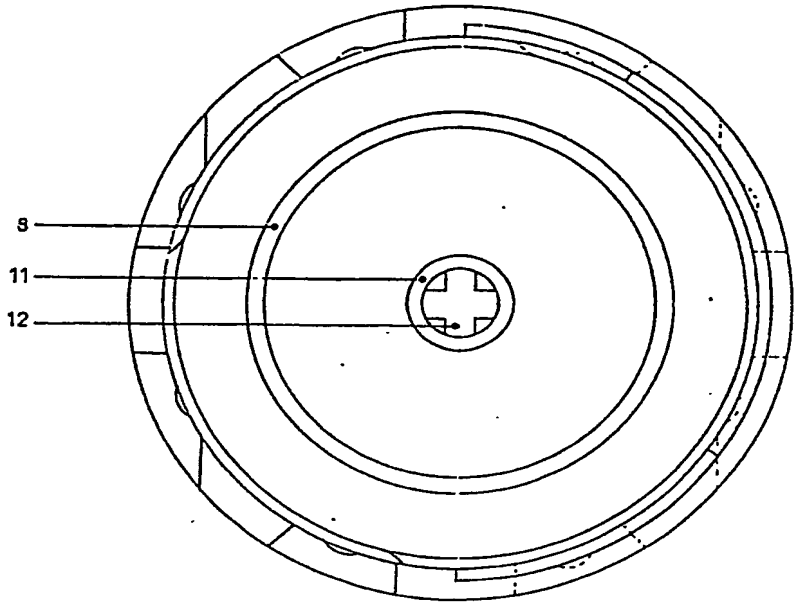

FIG 26

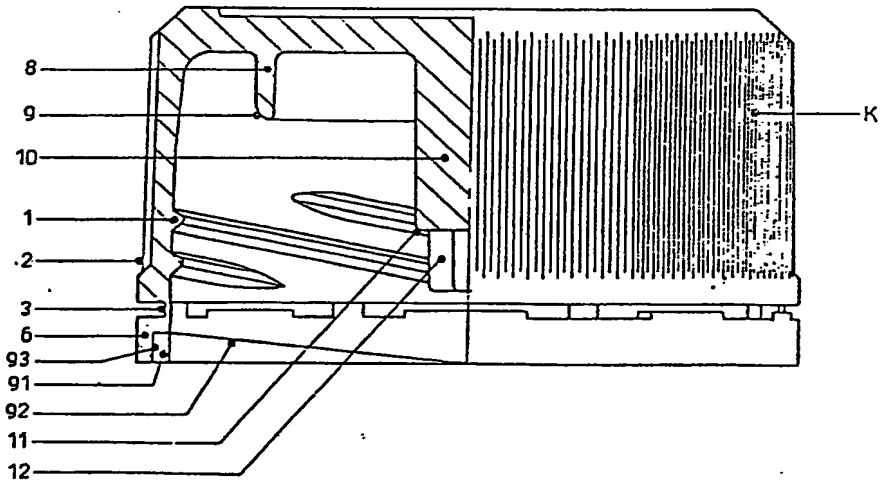

FIG 27

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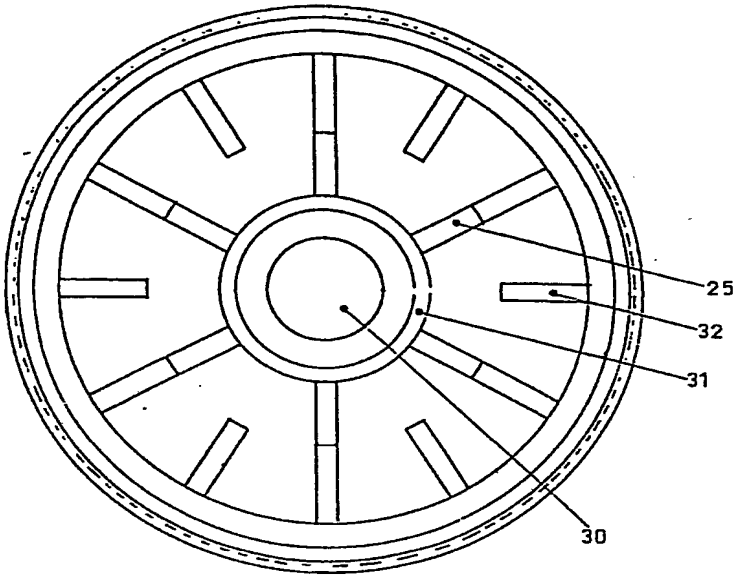

FIG 28

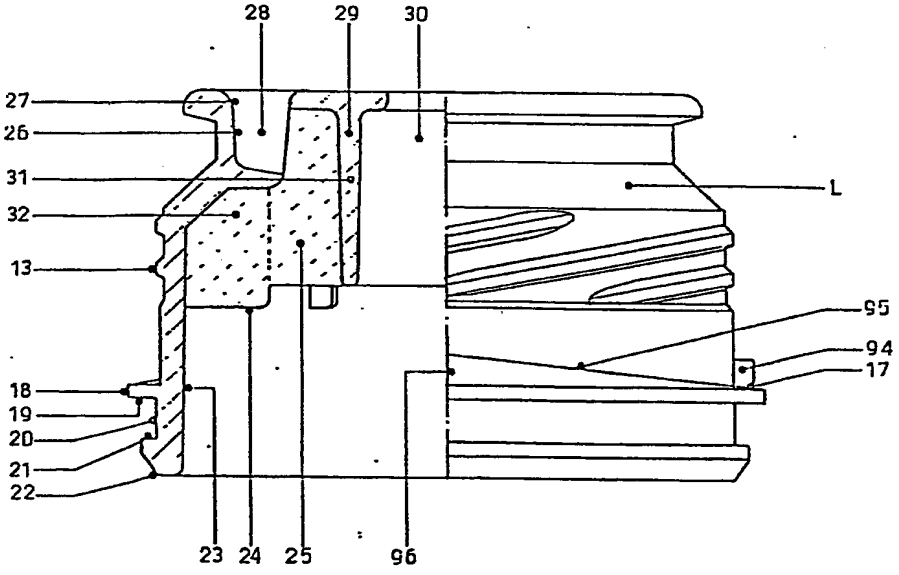

FIG 29

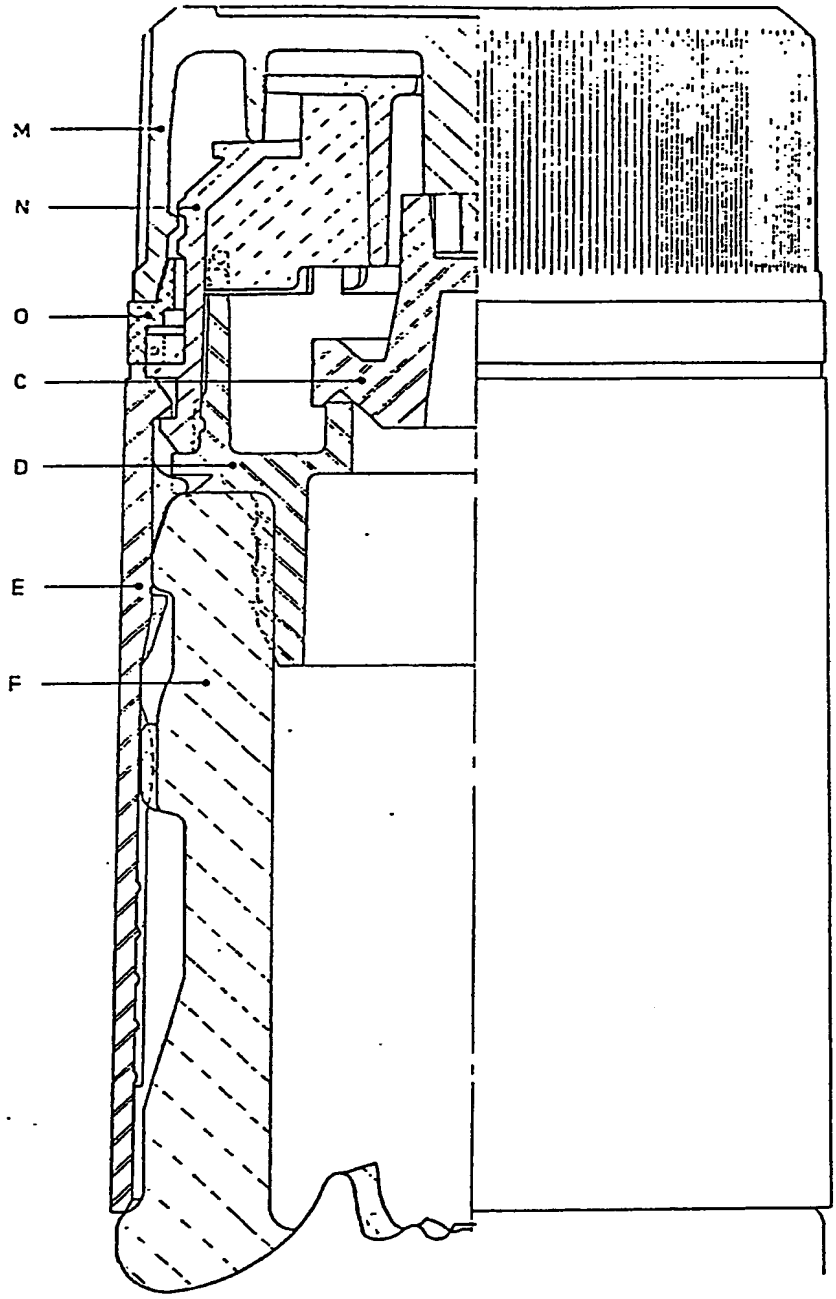

FIG 30

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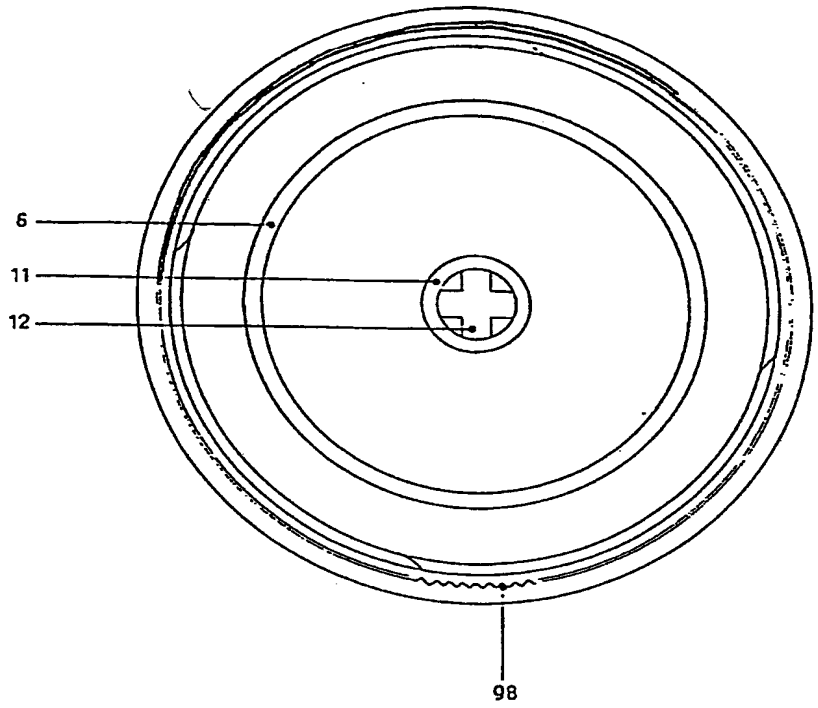

FIG 31

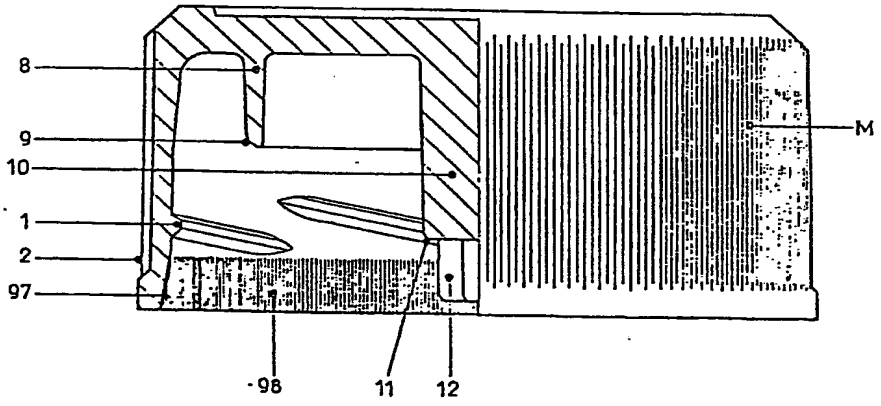

FIG 32

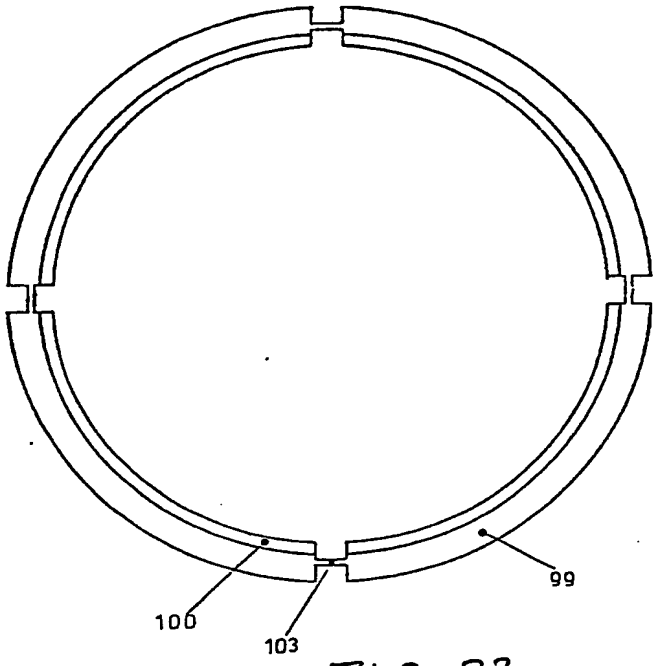

FIG 33

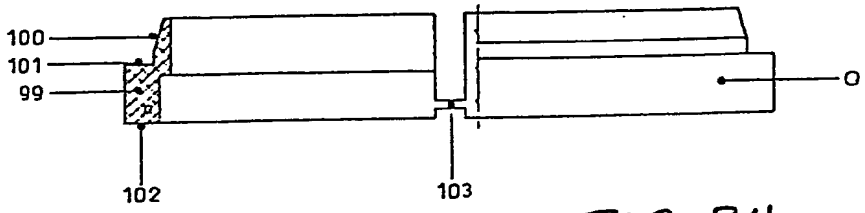

FIG 34

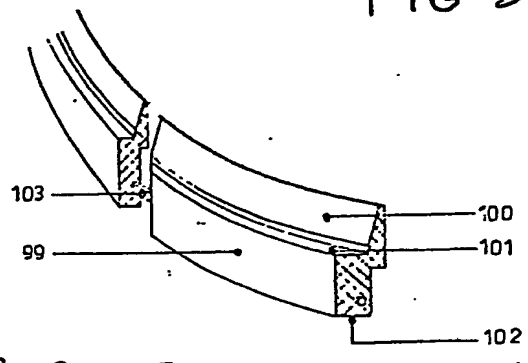

FIG 35

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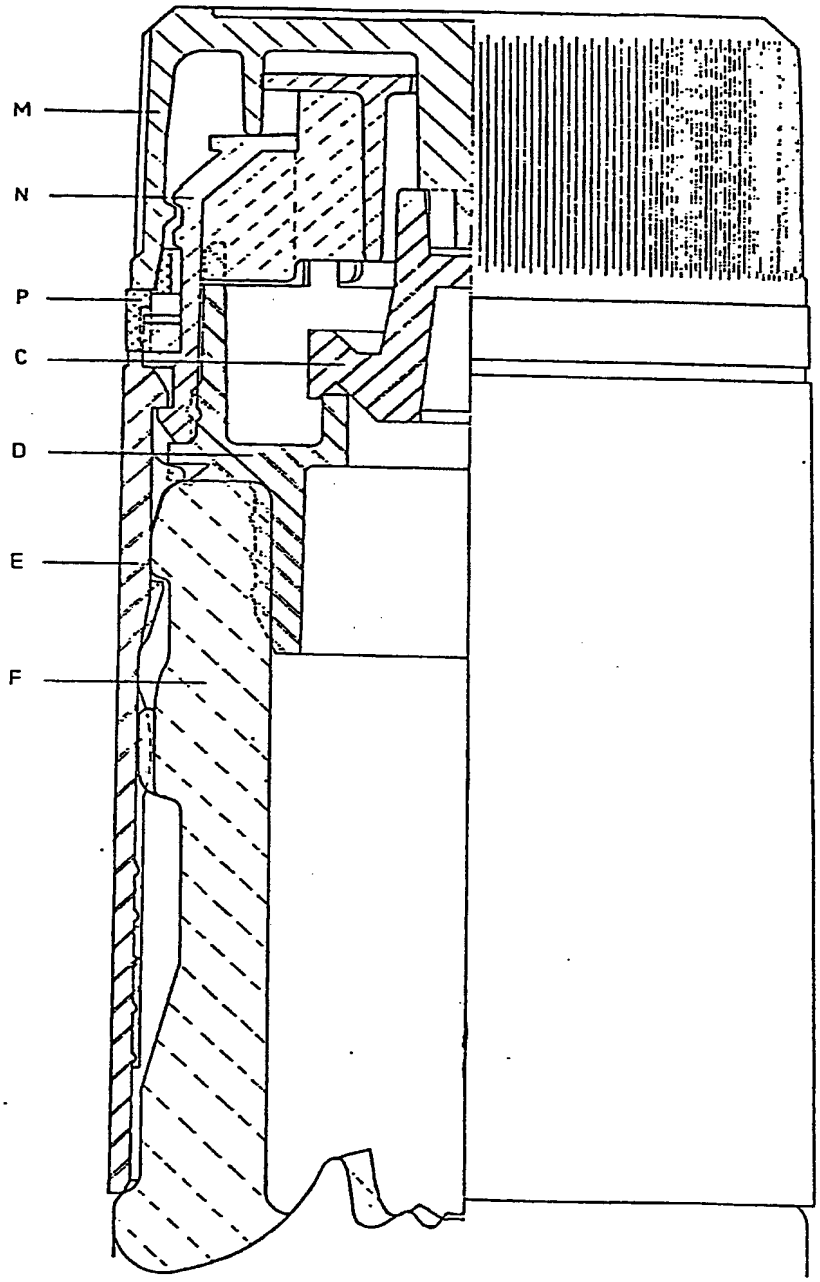

FIG 36

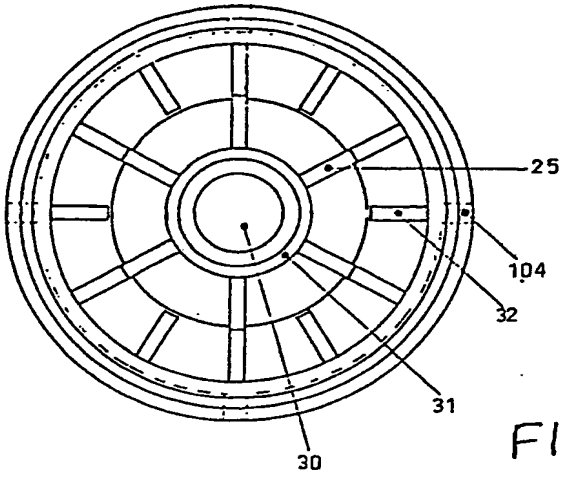

FIG 37

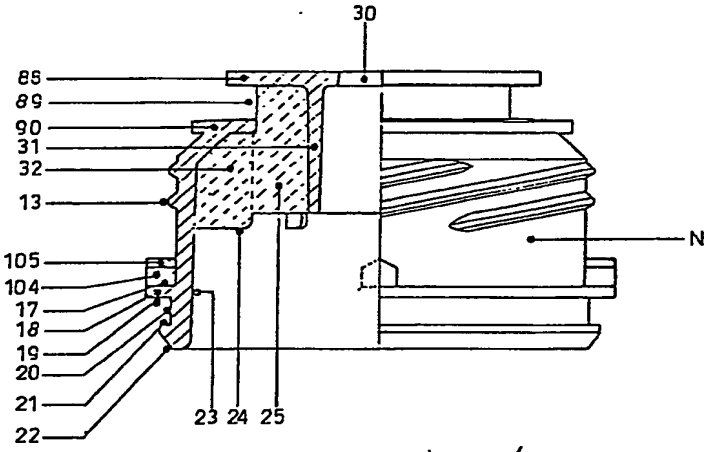

FIG 38

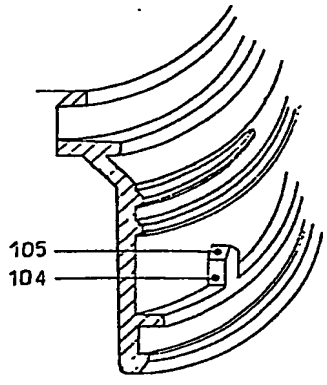

FIG 39

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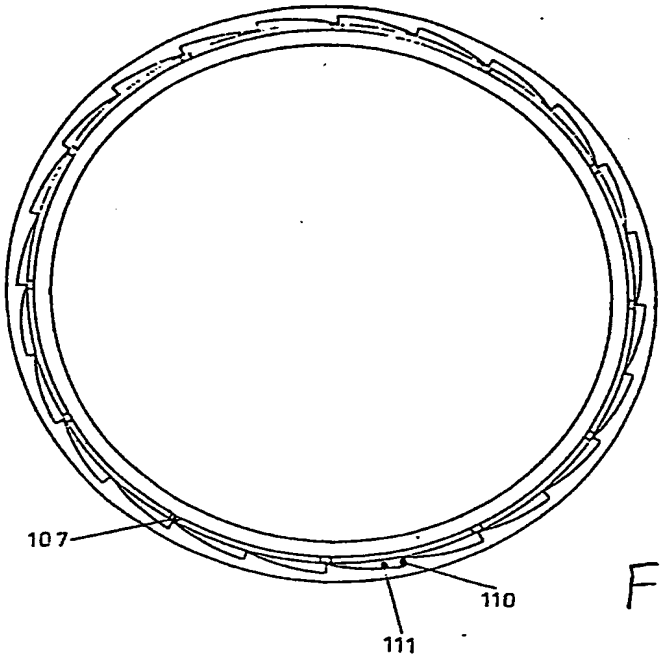

FIG 40

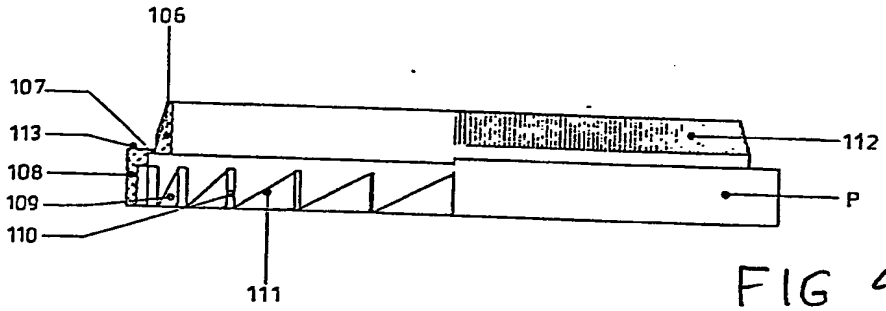

FIG 41

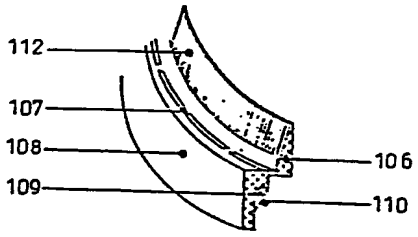

FIG 42

TAMPER-EVIDENT CLOSURE

The invention relates to tamper-evident closures (i.e. closures having means for indicating whether they have been undone since they were first assembled to a bottle or container) for bottles or similar containers having necks. The invention also relates to such tamper-evident closures which also have a mechanism preventing the bottle from being refilled with liquid after the closure has first been assembled onto the bottle.

Tamper-evident closures are known in the bottling industry, as are non-refillable closures. Which type of closure is used depends on the specific needs or wishes of the bottler, although, in general, it is highly desirable in the liquid bottling industry for closures to be tamper-evident and non-refillable. For some time, however, there has been a demand for a truly tamper-evident closure in which it is easy to assess whether the closure has previously been undone.

It is an object of the present invention to provide an effective tamper-evident closure, with low manufacturing costs, which is easy to install on a bottle and to use.

According to the present invention, a tamper-evident closure for a bottle or similar container comprises a retaining tube adapted to fit and be retained around the neck of the bottle; a seal member adapted to seal around the inside of the opening in the bottle; a pouring member having a pouring orifice and which is connected to the retaining tube and which forms a seal around the seal member; a screw cap

fastened to the pouring member by means of mutually engaging screw threads; and tamper-evident means for indicating whether the screw cap has been unscrewed since the closure was first assembled.

In use, the assembled closure is fitted on the neck of the bottle by means of vertical pressure, the tube sliding down over the neck of the bottle and being retained thereon.

Preferably, the seal member provides a valve seat which, together with a valve member, constitutes a valve for preventing liquid from entering the bottle.

In some embodiments, which may or may not incorporate a valve, the tamper evident means comprises a separate frangible ring located between the cap and retaining tube.

The term "frangible ring" is taken to mean a ring having portions which are easily broken, which are either broken when the cap is first unscrewed or which are broken during assembly of the closure. The "ring" may thus comprise a ring of material with frangible portions or a number of separate portions, arranged in a ring, retained in place in the closure until the cap is unscrewed. In either case it is clear to an observer whether the cap has been unscrewed after assembly, either because the ring is broken, or because the parts of the ring have fallen away when the cap was first unscrewed.

Alternatively, the means for indicating whether the cap has been unscrewed may comprise a ring which is connected to the bottom of the screw cap by frangible portions which are broken when the cap is unscrewed.

In this case the ring itself is not frangible but is connected via frangible portions or bridging

elements to the cap. In use, when the cap is unscrewed for the first time, the frangible portions are broken. It is immediately apparent to an observer whether the frangible portions have been broken or not and it is thus easy to determine whether the cap has been unscrewed since assembly of the closure.

The retaining tube preferably has on its inner surface a first series of inward projections which, in use, engage an annular shoulder on the neck of the bottle so as to prevent removal of the retaining tube from the bottle. Each projection preferably has a surface which is inclined with respect to the axis of the retaining tube whereby, in use, it may be pushed over the shoulder on the bottle, and a surface substantially perpendicular to the axis of the retaining tube which, in use, engages the shoulder when the retaining tube is in place and prevents the retaining tube being removed. The tube is ideally moulded from a resilient plastics material, whereby, in use, the projections may be compressed as the retaining tube is placed on the neck of the bottle and partly or totally recover their original shape once they have passed the shoulder on the bottle.

The projections ensure that it is impossible for the closure to be removed, once placed on the bottle neck, without being destroyed. The tube also provides an attractive covering for the upper part of the bottle neck.

The retaining tube also preferably has a series of axially aligned ribs spaced around its internal surface which, in use, engage with a corresponding series of ribs spaced around the neck of the bottle to prevent the retaining tube from rotating relative to the

bottle. The tube is thus prevented from rotating with respect to the bottle.

More preferably, a portion at the end of each retaining tube rib remote from the pouring member is of smaller inward extent than the maximum inward extent of the retaining tube rib whereby, in use, the alignment of the retaining tube ribs with the spaces between the bottle ribs is facilitated. Positioning may be further facilitated by rounding the remote end of each rib.

The tube may also have on its inner surface a second series of inward projections each of which extends into one of a series of locating cavities in the periphery of the seal member to prevent rotation of the retaining tube with respect to the seal member. Preferably the lower end of each projection in the said second series is inclined and/or curved, to facilitate the positioning of the retaining tube on the neck of the bottle. More preferably the said locating cavities are partially defined by an annular stop on the seal member with which the projections of the said second series cooperate to prevent axial downward movement of the seal member with respect to the retaining tube.

The seal member, valve member and pouring member may thus be prevented from rotating relative to the tube and the seal member may be prevented, in use, from passing too far into the tube before the closure is applied to a bottle.

The seal member normally has an annular depending sealing spigot having one or more first external annular sealing collars which, in use, seal hermetically against the inner surface of the bottle when the spigot is pushed into the bottle. It also normally has an upstanding annular sealing wall

carrying one or more second external annular sealing collars which seal hermetically against an internal surface of the pouring member.

Preferably, the seal member has at its upper end a series of locating teeth around its periphery which engage between a series of internal radial locating webs on the pouring member to prevent the seal member from turning relative to the pouring member.

If the closure is non-refillable, the valve member includes a downwardly facing sealing surface and the valve seat is an upwardly directed surface and the valve member is movable in the axial direction whereby, in use, when the closure is upright, the valve member rests on the valve seat and the respective sealing surfaces seal against each other. Thus, when the bottle is upright and the cap is unscrewed, the valve may be kept closed by the influence of gravity and it is then impossible to pour liquid into the bottle. When the bottle is tilted, the liquid in the bottle may act against the bottom of the valve member and move it axially, opening the valve and allowing liquid to pass out of the bottle.

Preferably also, the valve member is completely enclosed within the closure. In this case, it is impossible to interfere with the valve once the closure is in place on a bottle.

The valve seat is preferably provided by an internal tubular valve seat portion of the seal member and in that the said valve member has two mutually inclined annular sealing surfaces which, when the valve is closed, seal against a sealing surface at the end of the said tubular valve seat portion. Preferably also, the pouring member includes an internal tubular guide

portion which, in use, constrains the valve member to travel substantially in the axial direction only. The pouring member preferably also has an axially central aperture through which a rod, depending from the screw cap, extends and engages the valve member, holding it in contact with the valve seat.

The pouring member may afford a radially outwardly directed annular pouring orifice whose upper side is defined by a radially extending top plate which is continuous apart from the said aperture in its centre. The valve member may have an upwardly open recess into which a projection on the end of the rod extends and engages, whilst deforming the walls of the recess, so that, in use, the valve member turns with the cap when the cap is unscrewed.

The projection may have e.g. a cruciform shape to enable it to deform the walls of the cavity and therefore transmit a greater torque between the cap and the valve member. Because the valve member turns with the cap when the cap is unscrewed, any adhesion between the valve member and valve seat caused by liquid residues is broken, allowing the valve to operate correctly.

If the closure is refillable, that is to say if it has no valve, the seal member preferably includes an axially aligned annular pouring member locating surface which partially defines an annular locating cavity into which an annular axially aligned locating portion on the pouring member extends and forms a hermetic seal between the seal member and the pouring member.

Preferably, whether the closure incorporates a valve or not, the thread ridges comprising the said thread on the pouring member have an upper face which

is inclined to the vertical and/or curved and the thread ridges comprising the said thread on the screw cap have correspondingly inclined and/or curved lower faces so that, when the closure is initially assembled, the cap may be pressed onto the pouring member without screwing, the respective threads on the cap and pouring member overriding each other.

The screw cap of the closure preferably has depending from the inside surface of its top wall an annular sealing ring and there is preferably a hermetic seal between this ring and the pouring member, in use, preventing liquid from passing out of the bottle.

If the screw cap has a ring joined to it by frangible portions, it is preferable that this ring has an internal annular locking collar. The lower surface of the internal locking collar is preferably inclined to the vertical and/or curved so that, when the closure is being assembled, the locking collar may slide over an external retaining ridge on the pouring member and locate beneath it. The retaining ridge on the pouring member preferably affords an annular upper surface, inclined to the axis, and a radially extending lower surface, beneath which the ring is located. A further preferable feature of the ring is a series of upwardly extending lugs whereby, when the closure is being assembled and the locking collar slides past the retaining ridge, the said frangible portions are deformed and the lugs engage the body of the screw cap, limiting the deformation of the frangible portions and preventing them from breaking.

The ring may have a series of downwardly directed locking teeth on its internal surface which mesh with a corresponding series of locking teeth on the pouring

member, whereby, in use, the ring is prevented from turning when the cap is unscrewed from the pouring member, causing the frangible portions connecting the ring with the body of the cap to break, when the cap is first unscrewed. In this case the thread on the cap preferably has a plurality of entry points, as has the thread on the pouring member, and the entry points of the threads on the cap and pouring member preferably each coincide with a locking tooth on the ring or pouring member respectively.

If the ring is separate from the cap, it may be radially divided into a plurality of sectors which, prior to assembly of the closure, were joined by frangible portions which were broken during assembly, which sectors are retained in place between the screw cap and the pouring member and, in use, are released when the cap is unscrewed for the first time. In this case the screw cap preferably has an internal annular chamfered surface around its rim against which an external annular chamfered surface of the ring is located. The pouring member preferably has a series of breaking teeth on its outer periphery whose purpose is, during assembly of the closure, to break the frangible portions of the ring, separating it into several parts. The pouring member also preferably has an external annular abutment ridge on whose upper surface the said teeth are moulded and against which the said portions of the ring are retained.

If the ring is separate from the cap, it may alternatively comprise an upper and a lower annular member connected together by frangible portions. In this case the screw cap preferably has an internal annular chamfered surface around its rim which carries

a series of grooves. Also the upper member of the ring in this case preferably has an external annular chamfered surface which carries a series of grooves which engage the grooves on the cap, whereby, in use, the ring is caused to turn with the cap. Furthermore, in this case the lower member of the ring carries a series of teeth each tooth having a surface inclined to the axis and an axially extending surface, and the pouring member preferably includes a corresponding series of teeth whereby, during assembly, the inclined surfaces of the respective series of teeth may slide over each other when the cap is screwed onto the pouring member but, in use, when the cap is unscrewed the interengagement of the axially extending surfaces prevents the ring from turning with respect to the pouring member, causing the frangible portions to break.

It is generally preferred that all the component parts of the closure are retained together without the use of adhesives. More preferably, the component parts are retained together by screw connections or snap-fitting connections.

Further features and advantages of the invention will be apparent from the following description of four specific embodiments which is given by way of example only with reference to the accompanying drawings, in which:-

Figure 1 is a side view, partly in section, of the first embodiment of closure according to the invention, fitted to a bottle;

Figure 2 is a plan view from below of the screw cap of the first embodiment;

Figure 3 is a side view, partly in section, of the cap of Figure 2;

Figure 4 is a plan view from below of the pouring member of the first embodiment;

Figure 5 is a side view, partly in section, of the pouring member of Figure 4;

Figure 6 is a plan view from below of the sealing member of the first embodiment;

Figure 7 is a side view, partly in section, of the sealing member of Figure 6;

Figure 8 is a side view, partly in section, of the valve member of the first embodiment;

Figure 9 is a plan view from below of the valve member of Figure 8;

Figure 10 is a partial plan view from below of the retaining member of the first embodiment;

Figure 11 is a side view, partly in section, of the retaining member of Figure 10;

Figure 12 is a side view, partly in section, of a bottle suitable for use with all the embodiments of closure described;

Figure 13 is a section on the line A-A in Figure 12;

Figure 14 is a scrap view, on an enlarged scale, of the encircled portion of Figure 13;

Figure 15 is a side view, partly in section, of the second embodiment of closure according to the invention;

Figures 16 to 21 are views corresponding to Figures 2 to 7, respectively, of various parts of the second embodiment;

Figure 22 is a side view, partly in section, of the third embodiment of closure according to the invention;

Figure 23 is a plan view from below of the pourer

of the third embodiment;

Figure 24 is a side view, partly in section, of the pourer of Figure 23;

Figure 25 is a side view, partly in section, of the fourth embodiment of closure;

Figures 26 to 29 are views corresponding to Figures 2 to 5 of the fourth embodiment;

Figure 30 is a side view, partly in section, of the fifth embodiment of closure;

Figure 31 is a plan view from below of the screw cap of the fifth and sixth embodiments;

Figure 32 is a side view, partly in section, of the screw cap of Figure 31;

Figure 33 is a plan view from below of the ring of the fifth embodiment;

Figure 34 is a side view, partly in section, of the ring of Figure 33;

Figure 35 is a scrap perspective view of the ring of Figure 33;

Figure 36 is a side view, partly in section, of the sixth embodiment of closure;

Figure 37 is a plan view from below of the screw cap of the fifth and sixth embodiments;

Figure 38 is a side view, partly in section, of the screw cap of Figure 37;

Figure 39 is a scrap perspective view of the screw cap of Figure 37;

Figure 40 is a plan view from below of the ring of the sixth embodiment;

Figure 41 is a side view, partly in section, of the ring of Figure 40; and

Figure 42 is a scrap perspective view of the ring of Figure 40.

Referring to Figure 1, the first embodiment of closure comprises a tamper-evident screw cap A, a pouring member, or pourer B, a valve member C, a packing member or seal member D and a tubular retaining member or retaining tube E. The tube E, in use, fits over the neck of a bottle or container F.

Referring to Figures 2 and 3, the tamper-evident screw cap A has in the lower part thereof an internal screw thread 1 with one or more, e.g. four, entry points. The pourer B (see Figures 4 and 5) has an external screw thread 13 on its outer cylindrical surface by means of which the cap may be screwed onto the pourer. The cap A has a central depending actuating rod 10 which, when the cap is screwed onto the pourer, is inserted into a central circular aperture, or orifice 30 in the pourer and makes contact with the valve member (see Figures 8 and 9) in a circular section cavity or recess 51 in the top of the valve member. The end of the rod 10 carries a cross-shaped projection 12 which engages with and partially deforms the side walls of the cavity 51, whilst the periphery 11 of the end surface of the rod engages a circular rim 49 of the valve member, around the periphery of the cavity 51.

The valve member is thus pressed against the seal member D, whose horizontal circular sealing surface 33 (see Figures 6 and 7) functions as a valve seat, engaging corresponding inclined sealing surfaces 55, 56 on the valve member.

This vertical pressure exerted by the cap A, as it is screwed onto the pourer B, on the valve member C and the sealing member D ensures a hermetic seal, preventing liquid from coming out through the central

circular orifice 46 of the sealing member.

The valve member C tends to adhere or stick to the valve seat (sealing surface) 33 of the sealing member D, due to bonding caused by residues from the liquid contained in the bottle or container F.

When the cap A is turned to unscrew it from the pourer B, owing to the friction of the cross-shaped projection 12 of the rod 10 against the lateral walls 50 of the cavity 51 of the valve member C, the valve member turns with the cap and any bond between the valve member and the sealing surface 33 of the sealing member is broken.

Depending from the inside of the top of the cap is an annular sealing ring or flange 8 which makes a further seal against the pourer (see Figures 1, 2 and 3). The flange 8 has a curved end 9 to facilitate assembly of the cap to the pourer.

The outer vertical cylindrical surface 2 of the cap A has a series of vertical grooves allowing the cap to be manually gripped securely and thus to be fastened more securely when screwed onto the pourer B, and unfastened more easily.

The screw cap A has a ring 6 depending from the periphery of the main body of the cap which is connected to the body of the cap by means of frangible, vertically extending bridging elements or segments 3. The upper horizontal face of the ring 6 has a series of upstanding laterally elongate projections or lugs 4 which allow a vertical force to be transmitted between the body of the cap and the ring 6 when the cap is being screwed onto the pourer.

The ring 6 has on its inner face an annular locking collar 7 whose lower annular face 5 is inclined

and/or curved. The pourer B has an outwardly directed annular retaining ridge which has an upper inclined surface 14 and a lower horizontal surface 15. When the cap is screwed onto the pourer, the collar 7 of the ring 6 slides over the inclined surface 14 and engages an annular cavity 16 between the retaining ridge and another external annular ridge (an abutment ridge) 18 beneath that. A certain degree of force needs to be exerted in order for the collar 7 to slide over the inclined surface 14. During this process, the bridging elements 3 are deformed and the force between the ring and the cap body is transmitted via the projections 4 on the ring. The bridging elements are thus prevented from breaking when the cap is screwed onto the pourer. When the cap A is unscrewed for the first time from the pourer B, the ring 6 cannot be displaced upwards because the collar engages with the horizontal annular surface 15. The bridging elements or frangible portions of the screw cap must thus be broken in order to remove the cap, making it possible for a future user to detect that the cap has previously been unscrewed.

This separation of the ring 6 by the breaking of the frangible bridging elements 3 is the characteristic which makes the cap A tamper-evident in this embodiment.

The pourer B includes an inner member comprising a vertical tubular portion 31 on whose inner surface the valve member C is, in use, centred. This ensures that the valve member moves only along its axis, when the bottle or container F is inclined. The inner member is supported on a series of integral radial supporting webs 25.

At the top of the tubular portion 35 is a top

plate 29 which defines the circular orifice 30 into which the rod 10 of the cap A is, in use, inserted. The top plate 29 also partially defines an annular orifice 28 through which liquid flows out from the bottle or container F.

The upper part 27 of the inside surface 26 of the vertical outer wall of the pourer is curved. The purpose of this is, in use, to cut off the stream of liquid when the bottle is tipped back after pouring is finished, and prevent it from dripping down the outer walls of the pourer. The upper part 27 is so shaped that, when the bottle is returned from an inclined position to the vertical position, the liquid tends to run back inside the pourer.

The external annular abutment ridge 18 of the pourer limits the downward vertical displacement of the cap when it is screwed onto the pourer, since the ring 6 with its collar 7 has a smaller internal diameter than the diameter of the ridge 18 and thus engages the upper surface 17 of the ridge rather than moving further down the pourer.

The lower surface 19 of the ridge also serves as a stop for the retaining tube E when it is assembled together with the pourer B.

The pourer B, the valve member C and the seal member D have features which work together to prevent refilling of the bottle or container. To assemble these components the valve C is first placed inside the seal member and then the seal member is inserted, together with the valve member, inside the pourer.

The upper half of the seal member comprises an outer, upwardly extending, vertical cylindrical wall 35. The lower portion 37 of the wall 35 has an

increased diameter and on this portion are one or more collars 36 of even greater diameter whose purpose is to fit tightly against the internal surface 23 of the lower portion of the pourer and form a hermetic seal.

The upwardly directed peripheral surface 48 of the outer vertical cylindrical wall 35 of the seal member, in use, contacts the lower faces 24 of a series of vertical radial segments 32 inside the pourer. These segments 32 extend inwardly from the inner surface of the pourer and are located at equal intervals around the pourer. The engagement between the segments 32 and the wall 35 limits the amount by which the seal member D can project into the pourer B.

In order to prevent the pourer from turning relative to the seal member when the cap is unscrewed, a series of teeth 47 extend upwardly from the peripheral surface 48 of the wall 35 of the seal member which, in use, locate between the radial segments 32 of the pourer B. When the segments 32 of the pourer are engaged between the teeth 47 of the seal member, the pourer is prevented from turning relative to the valve seat.

In order to prevent the seal member D from turning relative to the retaining tube E when the cap is unscrewed, the seal member has a series of locating cavities 40 around its periphery which engage with internal teeth 62 on the tube E (see Figures 10 and 11).

The pourer B has an annular locking flange with an external chamfered face 22 at its base whose purpose is to facilitate assembly of the pourer B to the tube E by enabling it to slide over an internal chamfered face of a corresponding annular locking flange at the top of

the tube E, and thus allow an upwardly directed annular locking shoulder 21 on the pourer to hook over a corresponding locking shoulder 60 on the tube E. Between the shoulder 21 and external abutment ridge 18 on the pourer an annular cavity 20 is defined in which the flange on the tube extends.

It is very important that the pourer remains well fastened to the tube, not only to prevent the tube from being removed or from turning, but also to ensure that the seal member D remains in place and is not displaced or moved prior to the closure being installed on the neck of the bottle or container F. In order to achieve the above, the seal member is provided with an annular flange 39 against which the upper surface 61 of a first series of projections 62 in the tube E act, preventing the seal member D from being displaced down the tube. The circle defined by the radially innermost extent of the projections 62 is of a smaller diameter than the outer diameter of the flange 39 of the seal member D. The upper surface 38 of the flange 39 provides a stop for the pourer.

The anti-refilling mechanism of the closure is thus prevented from turning because the projections 62 of the tube E axially restrain the seal member so that they remain meshed with the locating cavities 40 around the periphery of the seal member, preventing the seal member from turning relative to the tube.

Inside of and coaxial with the outer vertical cylindrical wall 35 of the seal member is an inner vertical central portion 35 including an upstanding tubular portion 34 whose upper end face is a sealing surface 33 whose purpose is to prevent liquid from flowing out through the circular orifice 46 defined by

the tubular portion 34, when the cap is closed. It does this by contacting and sealing with inclined annular sealing surfaces 54 and 55 on the valve member C, when the valve member is pressed down by the rod 10 of the cap A.

In the lower part of the seal member D a depending annular sealing spigot 43 is provided which has on its outer surface a series of rings 42 whose purpose is to provide a hermetic seal against the inside surface 77 of the bottle or container F (see Figures 12, 13 and 14). A further seal is provided by a radially extending annular surface 41 adjacent the top of the spigot.

In order to facilitate the insertion of the sealing spigot 43 into the neck of the bottle or container F, the spigot has an external chamfer 44 at its lower end which may be curved. The inside surface 73 of the rim 74 of the bottle F is also curved.

The valve member C has a central cavity 56 whose purpose is to facilitate and cut down the time for moulding the member. The cylindrical outermost surface of the valve is designated 53 in Figure 8 and the cylindrical surface which cooperates with the depending tubular portion 31 of the pourer is designated 52. When the closure is placed on the neck of the bottle F, a further set of internal projections, or anchors, 64 on the tube remain firmly fastened underneath a flared portion at the top of the bottle, engaging with the horizontal lower surface 76, or shoulder, of the flared portion. The lower surface 65 of each anchor 64 is inclined to make it easier to slide it over the inclined outer surface 75 of the flared portion on the neck of the bottle F and into position with the upper

surface 63 of the anchors under the lower surface 76 of the flared portion. Because the diameter of the circle defined by the inmost extent of the anchors 64 is less than the greatest diameter of the flared portion of the bottle F, the closure cannot be removed from the bottle F because, if this is attempted, the anchors 64 of the tube E engage with the circular lower horizontal surface 76.

A series of vertically elongate, radially inwardly projecting segments or lugs 69 are provided on the inside surface of the lower part of the tube E. The maximum radially inward extent of each of these lugs is at a point 67 at which the lugs cooperate with a number of vertical ribs 78 on the outside of the neck of the bottle F, when the closure is in place. The purpose of these is to prevent the tube E from turning relative to the bottle F when the cap A is unscrewed by virtue of the interengagement between the lugs 69, at or around the points 67, with the vertical ribs 78 on the bottle.

The lugs 69 have inclined surfaces 66 and 68 above and below the point 67 whose purpose is to facilitate their moulding and positioning on the neck of the bottle. The lugs each have a portion of reduced radial extent which extends downwardly ending in a curved surface 71.

The lower end of the cylindrical wall 70 of the tube E has a curved surface 72 whose purpose is to facilitate the assembly of the tube E on the neck of the bottle F. When the closure is in place on the bottle, the tube E ends at a corresponding curved shoulder 79 on the bottle and the tube is thus flush with the surface of the bottle below the shoulder 79.

At the top of the tube is an internal upwardly

directed shoulder 57 on which the lower face 19 of the external ridge 18 on the pourer B rests when the closure is assembled. Adjacent the shoulder 57 is an upwardly extending annular ridge having a horizontal annular end surface 58 which covers the annular outer surface of the external ridge 18 on the pourer B so that it is not visible when the pourer is assembled with the tube E.

A second embodiment of tamper-evident closure, shown in Figures 15 to 21, has no anti-refilling mechanism. Referring to Figure 15, the closure comprises a screw cap G, a pourer H, a sealing member I, a retaining tube E. The bottle is designated F. In this embodiment the principal function of the closure is that of being tamper-evident, for which reason the valve member C is not necessary. In addition the cap has been changed from the first embodiment, eliminating the rod, because the valve member has been eliminated. The pourer has been changed by opening up the central part to provide a circular orifice 83 and the seal member no longer provides a valve seat.

Apart from the features mentioned above the tamper-evident screw cap G is of exactly the same design as the cap A of the first embodiment, and operates in the same way as already described.

When the pourer H is assembled with the seal member I, a depending annular member 82 inside the pourer locates in a corresponding annular cavity 86 inside the seal member I. The inner cylindrical surface 87 of the cavity 86 in the seal member contacts the inner cylindrical surface 81 of the member 82 in the pourer H, forming a hermetic seal to prevent liquid from passing between these two surfaces. The lower end

of the annular member 82 of the pourer H has a curved surface 80 to facilitate assembly into the annular cavity 86.

The outer cylindrical wall 35 of the seal member of the second embodiment is a depending wall which, together with a main annular wall 84, defines an annular cavity 85. The purpose of the cavity 85 is to facilitate the moulding of the seal member. The external diameter of an enlarged diameter lower portion 37 of the external wall 35 is the same as the external diameter of the corresponding portion 37 of the seal member D of the first embodiment. The portion 37 of the seal member in the second embodiment has collars 36, similar to those in the first embodiment, which seal against the inner surface 23 of the pourer H in a similar manner to the first embodiment.

The remaining features of the seal member I and pourer H including the way they are assembled are similar to those of the seal member D and pourer H of the tamper-evident non-refillable closure of the first embodiment.

The tube E operates in the same way in the first and second embodiments and is exactly the same design in each case.

The neck of the bottle or container F, including the crown, is the same in each embodiment.

Referring now to Figures 22 to 24, the third embodiment is a tamper-evident, non-refillable closure which is the same as the first embodiment in all respects excepting that the annular outlet orifice 89 through which liquid may be poured is in the side of the pourer J, as shown in Figure 24, instead of being in the top of the pourer, as in the first embodiment.

The top of the outlet orifice is defined by an annular top plate 88 which also defines a central circular orifice 30 through which the rod 10 of the cap is inserted.

A horizontal annular flange 90 defines the bottom of the annular outlet orifice.

All the other parts of the pourer J of the third embodiment are the same as in the first embodiment, as are those of the tamper-evident cap A, seal member D, valve member C, tube E and bottle or container F. The way in which these components operate is also the same as in the first embodiment.

Referring now to Figures 25 to 29, the fourth embodiment closure includes a tamper-evident cap K which is the same as that of the first embodiment, with the exception that the design of the tamper-evident ring has been changed. Corresponding changes have been made to the lower part of the pourer L.

The remaining parts of the closure are the same as the first embodiment, only the screw cap K and pourer L being different.

The ring 6 of the cap K is different from the ring 6 of the cap A, in that the cylindrical collar 7 of the ring of the cap A has been replaced by four teeth 91 each having an inclined surface 92 and a vertical surface, or end, 93. The teeth prevent the ring 6 from turning when the cap K is unscrewed from the pourer L by engaging with four similar teeth 94 on the pourer, each having an inclined surface 95 and a vertical surface, or end, 96.

The cap K has an internal thread 1 with four entry points. The cap may be screwed onto the pourer L by means of a corresponding external thread 13 on the

pourer L. The four entry points of each thread are adjacent the ends 93, 96 of the teeth 91, 94 of the cap and pourer respectively. This ensures that, when the cap K is screwed onto the pourer L, the ends 93 of the teeth 91 of the cap come into engagement with the ends 93 of the teeth 94 of the pourer. The ring 6 is thereby prevented from turning when the cap K is unscrewed from the pourer L, and the bridging elements 3 connecting the ring 6 with the body 2 of the cap K may be broken.

The four teeth 91 of the cap K are moulded on the inner face of the ring 6 and the four teeth 94 of the pourer L are moulded on the outer face of the annular external ridge 18 on the pourer L.

When the cap K is screwed onto the pourer L for the first time, the bridging elements 3 connecting the ring 6 to the body 2 of the cap K are not broken, because the inclined surfaces 92 of the teeth 91 of the cap K slide across the inclined surfaces 95 of the teeth 94 of the pourer L until the cap is fully screwed onto the pourer, at which point the ends 93 of the cap K and those 96 of the pourer L are engaged.

Once the cap K has been unscrewed from the pourer L, the ring 6 is unrestrained in the upward direction and can be removed without difficulty.

The other parts of the fourth embodiment of closure operate as already described. The above described design of ring 6 and corresponding portion of the pourer may be incorporated into any of the foregoing embodiments.

Referring now to Figures 30 to 35 and Figures 37 to 39, a fifth embodiment of tamper-evident, non-refillable closure comprises a cap M, pourer N and

ring O. The valve member C, seal member D, retaining tube E and bottle F are as in previous embodiments.

In this embodiment, the screw cap M is different from those described in the foregoing embodiments, in that the ring O is separate from the cap M: the ring and cap are not connected together by frangible bridging elements.

In this embodiment, a portion 97 of the inside surface of the cap M adjacent the rim, is chamfered (see Figures 31 to 32). The chamfered surface 97 carries a series of vertical grooves 98 which serve no purpose in this embodiment, but which are necessary in the sixth embodiment which also incorporates this design of cap. In this embodiment the grooves are optional. An upper annular portion of the ring O (see Figures 33 to 35) fits inside the cap, an external annular chamfered surface 100 of the said upper portion engaging the surface 97 of the cap.

When this closure is fitted together, once the tube has been assembled with the anti-refilling mechanism formed by the pourer N, the valve member C and the seal member D, the ring O is pushed, with the annular chamfered surface 100 uppermost, down onto the pourer N. The ring O comprises four segments, adjacent segments being connected together by thin frangible bridging elements 103. The pourer N (see Figure 39) has four upwardly directed teeth 104 around its periphery, with pointed upper ends 105. Before it is pushed onto the seal member, the ring O is rotated so that the four gaps between the segments of the ring, in which the bridging elements are located, are in registry with the teeth 104 of the pourer N. The ring is then pushed down and the teeth 104 locate in the

gaps.

When the cap M is screwed or pressed onto the pourer N for the first time, the external annular chamfered surface 100 of the ring locates against the internal chamfered surface 97 of the cap so that the cap and ring are concentric. At the same time, the lower face, or rim, of the cap M makes contact with an upwardly directed annular shoulder 101 on a lower annular member 99 of the ring O, displacing the ring O downwards and forcing the teeth 104 against the four bridging elements 103 connecting the four segments of the ring O, and thus breaking them. The pointed upper ends 105 of the teeth 104 assist this process.

The upper and lower faces of the ridges comprising the screw threads 1, 13 on the cap and on the pourer are inclined and/or curved. This enables the closure to be assembled by simply pressing the cap onto the pourer. In this embodiment, the cap may be screwed or pressed onto the pourer until the grooves 98 on the internal chamfered surface of the cap engage the corresponding grooves on the ring O. At this point, since the ring cannot turn and since the cap and ring are unable to rotate relative to each other, the cap must be pressed down to break the frangible segments of the ring.

The ridges comprising the screw threads in the preceding embodiments are the same and it is therefore also possible in these embodiments to press the cap onto the pourer during assembly of the closure.

When the cap M is fully screwed/pressed onto the pourer N, the ring O, although separated into four parts, is retained by contact with the chamfered surface 97 of the cap M, the underneath surface 17 of

the external ridge 18 of the pourer N, and the annular end surface 58 of the tube E. The external chamfered surface 100 of the ring O is also retained against the internal chamfered surface 97 of the cap M: this keeps the ring O in place while the cap M remains screwed onto the pourer N.

When the cap M is unscrewed for the first time the ring O is released and the four sections of the ring O fall away sidewards because there is nothing to keep them in place.

When the cap M is screwed back onto the pourer N, there is a gap between the cap and the top of the tube, where the ring O had been, making it evident that the cap M has previously been unscrewed.

Referring now to Figures 36 to 42 and Figures 31 and 32, a sixth embodiment of closure will be described, whose components are identical to those of the fifth embodiment, with the exception of the ring, which in this embodiment is designated P.

The ring P is different from those previously described, in that the ring is toothed, and also in other respects as follows. The ring comprises upper and lower annular members 106, 108. The upper member 106 has a smaller diameter than the lower member 108, and the lower rim of the upper member is joined to the upper rim of the lower member by horizontal frangible bridging elements 107, spaced at equal intervals around its periphery.

The horizontal bridging elements 107 are designed to break or fracture when the cap M is unscrewed from the pourer N for the first time, thus providing an indication that the cap has been unscrewed. Teeth 109 are moulded into the internal surface of the lower

annular member 108, which extend to the lower rim of the lower member. Each tooth 109 comprises a vertical surface 110 and an inclined surface 111. The external surface of the upper member is chamfered, and the chamfered surface carries a series of grooves 112.

The screw cap M is the same as that in the fifth embodiment, but the vertical grooves 98 covering the whole of the chamfered surface 97, are essential in this embodiment.

When the closure is fitted together, once the tube E has been assembled to the anti-refilling mechanism comprising the pourer N, the valve member C and the seal member D, the ring P is pushed, with the upper annular member 106 uppermost, onto the pourer N. The screw cap M is screwed over the pourer N, or pressed onto the pourer using vertical pressure, the thread 1 of the cap M jumping over the thread 13 of the pourer N. The upper annular member 106 locates inside the cap and the chamfered surface of the member 106 engages the chamfered surface 97 of the lower part of the cap M. The lower annular member 108 of the ring P is located between the cap and the upper surface 17 of the external ridge 18 of the pourer N, with the lower surface 102 of the ring engaging the surface 17 of the pourer.

Once the cap M is screwed or pressed onto the pourer N, a small turn of the cap M is required to secure it to the pourer N. The inclined surfaces 111 of the teeth slide across the pointed upper parts 105 of the teeth 104 of the pourer and thus allow the ring to be turned in the direction which tightens the cap M onto the pourer. The ring turns with the cap M because the grooves 112 of the chamfered surface of the upper

member 106 engage with corresponding grooves 98 on the cap. When the cap has been forceably screwed onto the pourer to its fullest extent the teeth 104 moulded in the upper surface 17 of the external ridge 18 engage with the teeth 109 of the lower member 108 of the ring P.

Whilst the teeth 109 may jump or slide over the teeth 104 of the pourer when the cap is screwed onto the pourer, owing to the inclined surface 111 of the teeth 109, when the cap M is unscrewed from the pourer N for the first time the vertical faces 111 of the teeth 109 contact the teeth 104 on the pourer, and the ring is unable to move relative to the pourer. The ring P also cannot turn relative to the cap because of the interference between the grooved surfaces 98 and 112. Thus, the toothed lower member 108 of the ring P cannot turn and the upper member 106 of the ring P is obliged to turn together with the cap M: the horizontal bridging elements 107 connecting the members 106 and 108 therefore must break, enabling the ring P to separate into two parts. The toothed lower member 108 remains fixed on the pourer N and the upper member 106 of the ring P comes loose, together with the cap M, when the cap is unscrewed from the pourer N for the first time.

After the cap has been unscrewed from the pourer for the first time, it is obvious to an observer that the bridging elements 107 have been broken. Once the cap has been unscrewed from the pourer, both the upper and lower members of the ring can easily be removed and discarded and then, when the cap is screwed back onto the pourer, there is an obvious gap below the cap. In either case, it is thus clearly evident when the cap

has been unscrewed from the pourer N.

It will be apparent to the skilled man that many of the parts of the foregoing embodiments are interchangeable to create a tamper-evident/non-refillable closure of the desired design, or a simply tamper-evident closure of the desired design.

All the embodiments of closure are extremely easy to fit on the neck of a bottle, since in each case all that is needed is vertical pressure on the closure to fasten it onto the neck of a bottle. As the closure is pressed onto the bottle, the first series of projections on the inner surface of the retaining tube engage beneath a shoulder on the bottle neck and the closure is thus retained on the bottle.

In all the embodiments described, the various parts of the closure may be snap-fitted, screw-fitted or otherwise fitted together by means only of applied pressure, without the use of adhesives.

The various parts of the closures are manufactured from various thermoplastic materials, such as polypropylene, polystyrene and polyethylene. The precise material in each case is determined in accordance with the requirements and the function of each part.

The tube is moulded using collapsible or folding male mould parts. This is because of the various projections on the inner surface of the tube which require such a mould in order to enable the tube to be released when it is removed from the mould.

It will be appreciated that, whilst the embodiments described are designed to function with a bottle having ribs on the outer surface of its neck, the retaining tube could easily be adapted to fit a

conventional bottle having only a flared portion at the top of the neck.

CLAIMS

1. A tamper-evident closure for a bottle or similar container comprising a retaining tube adapted to fit and be retained around the neck of the bottle; a seal member adapted to seal around the inside of the opening in the bottle; a pouring member having a pouring orifice and which is connected to the retaining tube and which forms a seal around the seal member; a screw cap fastened to the pouring member by means of mutually engaging screw threads; and tamper-evident means for indicating whether the screw cap has been unscrewed since the closure was first assembled.

2. A closure as claimed in Claim 1 wherein the seal member provides a valve seat which, together with a valve member, constitutes a valve for preventing liquid from entering the bottle.

3. A closure as claimed in Claim 1 or Claim 2 wherein the tamper-evident means comprises a separate frangible ring located between the cap and retaining tube.

4. A closure as claimed in Claim 1 or Claim 2 wherein the tamper evident means comprises a ring which is connected to the bottom of the screw cap by frangible portions which are broken when the cap is unscrewed.

5. A closure as claimed in any one of Claims 1 to 4, characterised in that the retaining tube has on

its inner surface a first series of inward projections which, in use, engage an annular shoulder on the neck of the bottle so as to prevent removal of the retaining tube from the bottle.

6. A closure as claimed in Claim 5, characterised in that each projection of the first series has a surface which is inclined with respect to the axis of the retaining tube whereby, in use, it may be pushed over the shoulder on the bottle, and a surface substantially perpendicular to the axis of the retaining tube which, in use, engages the shoulder when the retaining tube is in place and prevents the retaining tube being removed.

7. A closure as claimed in Claim 5 or Claim 6, characterised in that the retaining tube is moulded from a resilient plastics material, whereby, in use, the projections may be compressed as the retaining tube is placed on the neck of the bottle and partly or totally recover their original shape once they have passed the shoulder on the bottle.

8. A closure as claimed in any one of the preceding claims characterised in that the retaining tube has a series of axially aligned ribs spaced around its internal surface which, in use, engage with a corresponding series of ribs spaced around the neck of the bottle to prevent the retaining tube from rotating relative to the bottle.

9. A closure as claimed in Claim 8, characterised in that a portion at the end of each

retaining tube rib remote from the pouring member is of smaller inward extent than the maximum inward extent of the retaining tube rib whereby, in use, the alignment of the retaining tube ribs with the spaces between the bottle ribs is facilitated.

10. A closure as claimed in Claim 8 or Claim 9, characterised in that the said remote end of each retaining tube rib is rounded to facilitate positioning of the retaining tube ribs between the bottle ribs.

11. A closure as claimed in Claim 5 or any subsequent claim, characterised in that the retaining tube has on its inner surface a second series of inward projections each of which extends into one of a series of locating cavities in the periphery of the seal member to prevent rotation of the retaining tube with respect to the seal member.

12. A closure as claimed in Claim 11, characterised in that the lower end of each projection in the said second series is inclined and/or curved, to facilitate the positioning of the retaining tube on the neck of the bottle.

13. A closure as claimed in Claim 11 or Claim 12, characterised in that the said locating cavities are partially defined by an annular stop on the seal member with which the projections of the said second series cooperate to prevent axial downward movement of the seal member with respect to the retaining tube.

14. A closure as claimed in any one of the

preceding claims, characterised in that the end of the retaining tube remote from the seal member has an internal curved surface to facilitate positioning and, in use, to enable the retaining tube to fit flush against the neck of the bottle when the closure is in place.

15. A closure as claimed in any one of the preceding claims, characterised in that the retaining tube has at its upper end an internal annular locking flange with a chamfered annular surface, the locking flange defining an annular locking shoulder substantially perpendicular to the axis against which a corresponding locking shoulder on a corresponding external locking flange on the lower end of the pouring member engages to restrain axial relative movement in one direction between the tube and the pouring member.

16. A closure as claimed in any one of the preceding claims, characterised in that the retaining tube has an axially extending annular ridge at its upper end which extends around part of the pourer.

17. A closure as claimed in any one of the preceding claims, characterised in that the seal member has an annular depending sealing spigot having one or more first external annular sealing collars which, in use, seal hermetically against the inner surface of the bottle when the spigot is pushed into the bottle.

18. A closure as claimed in Claim 17, characterised in that the end of the sealing spigot of the seal member is rounded to facilitate its insertion

into the opening in the bottle.

19. A closure as claimed in Claim 17 or Claim 18, characterised in that the seal member has an upstanding annular sealing wall carrying one or more second external annular sealing collars which seal hermetically against an internal surface of the pouring member.

20. A closure as claimed in any one of Claims 17 to 18, characterised in that the seal member has at its upper end a series of locating teeth around its periphery which engage between a series of internal radial locating webs on the pouring member to prevent the seal member from turning relative to the pouring member.

21. A closure as claimed in Claim 2 or any claim when dependent thereon, characterised in that the valve member includes a downwardly facing sealing surface and in that the valve seat is an upwardly directed surface and the valve member is movable in the axial direction whereby, in use, when the closure is upright, the valve member rests on the valve seat and the respective sealing surfaces seal against each other.

22. A closure as claimed in Claim 2 or any claim when dependent thereon wherein the valve member is completely enclosed within the closure.

23. A closure as claimed in Claim 2 or any claim when dependent thereon, characterised in that the said valve seat is provided by an internal tubular valve

seat portion of the seal member and in that the said valve member has two mutually inclined annular sealing surfaces which, when the valve is closed, seal against a sealing surface at the end of the said tubular valve seat portion.

24. A closure as claimed in any one of the preceding claims except Claim 2 or any claim when dependent thereon, characterised in that the seal member includes an axially aligned annular pouring member locating surface which partially defines an annular locating cavity into which an annular axially aligned locating portion on the pouring member extends and forms a hermetic seal between the seal member and the pouring member.

25. A closure as claimed in any preceding claim, characterised in that the thread ridges comprising the said thread on the pouring member have an upper face which is inclined to the vertical and/or curved and in that the thread ridges comprising the said thread on the screw cap have correspondingly inclined and/or curved lower faces so that, when the closure is initially assembled, the cap may be pressed onto the pouring member without screwing, the respective threads on the cap and pouring member overriding each other.

26. A closure as claimed in any one of Claims 1, 3 or 4, characterised in that the pouring member has a central pouring orifice defined by a vertical cylindrical surface which is curved at the top, in use, to prevent liquid from dripping down the side of the pourer after the bottle has been tilted to pour liquid

and then returned to an upright position.

27. A closure as claimed in any one of the preceding claims, characterised in that the pouring member affords a radially outwardly extending annular abutment surface which serves as a stop for the screw cap and the retaining tube.

28. A closure as claimed in Claim 2 or any subsequent claim when dependent thereon, characterised in that the pouring member includes an internal tubular guide portion which, in use, constrains the valve member to travel substantially in the axial direction only.

29. A closure as claimed in Claim 21 or Claim 23, characterised in that the pouring member has an axially central aperture through which a rod, depending from the screw cap, extends and engages the valve member, holding it in contact with the valve seat.

30. A closure as claimed in Claim 29, characterised in that the pouring member affords a radially outwardly directed annular pouring orifice whose upper side is defined by a radially extending top plate which is continuous apart from the said aperture in its centre.

31. A closure as claimed in Claim 29 or Claim 30, characterised in that the valve member has an upwardly open recess into which a projection on the end of the rod extends and engages, whilst deforming the walls of the recess, so that, in use, the valve member turns

with the cap when the cap is unscrewed.

32. A closure as claimed in any one of Claims 29 to 31, characterised in that the top surface of the valve member is an annular radially extending surface which is engaged by a corresponding surface on the rod.

33. A closure as claimed in Claim 28 or any claim when dependent thereon, characterised in that the valve member has upper and lower substantially axially extending cylindrical surfaces which cooperate, in use, with the internal surface of the said tubular guide portion of the pouring member.

34. A closure as claimed in Claim 29 or any claim when dependent thereon, characterised in that the said rod is generally cylindrical and the said aperture in the top plate of the pourer is circular.

35. A closure as claimed in any one of the preceding claims, characterised in that the cap has depending from the inside surface of its top wall an annular sealing ring and that there is a hermetic seal between this ring and the pouring member, in use, preventing liquid from passing out of the bottle.

36. A closure as claimed in Claim 25 or any claim when dependent thereon, characterised in that the thread ridges on the cap have upper and lower faces which are inclined to the vertical and/or curved to facilitate the production of the cap by moulding.

37. A closure as claimed in Claim 4 or any claim

when dependent thereon, characterised in that the ring has an internal annular locking collar.

38. A closure as claimed in Claim 37, characterised in that the lower surface of the locking collar is inclined to the vertical and/or curved so that, when the closure is being assembled, the locking collar may slide over an external retaining ridge on the pouring member and locate beneath it.

39. A closure as claimed in Claim 38, characterised in that the retaining ridge on the pouring member affords an annular upper surface, inclined to the axis, and a radially extending lower surface, beneath which the ring is located.

40. A closure as claimed in Claim 38 or Claim 39, characterised in that the minimum diameter of the locking collar of the ring is smaller than the maximum diameter of the retaining ridge.

41. A closure as claimed in any one of Claims 38 to 40, characterised in that the ring has on its upper surface a series of upwardly extending lugs whereby, when the closure is being assembled and the locking collar slides past the retaining ridge, the said frangible portions are deformed and the lugs engage the body of the screw cap, limiting the deformation of the frangible portions and preventing them from breaking.

42. A closure as claimed in Claim 4, characterised in that the ring has a series of downwardly directed locking teeth on its internal

surface which mesh with a corresponding series of locking teeth on the pouring member, whereby, in use, the ring is prevented from turning when the cap is unscrewed from the pouring member, causing the frangible portions connecting the ring with the body of the cap to break, when the cap is first unscrewed.

43. A closure as claimed in Claim 42, characterised in that the thread on the cap has a plurality of entry points, as has the thread on the pouring member, and in that the entry points of the threads on the cap and pouring member each coincide with a locking tooth on the ring or pouring member respectively.

44. A closure as claimed in Claim 43, characterised in that each thread has four entry points.

45. A closure as claimed in Claim 3, characterised in that the ring is radially divided into a plurality of sectors which, prior to assembly of the closure, were joined by frangible portions which were broken during assembly, which sectors are retained in place between the screw cap and the pourer and, in use, are released when the cap is unscrewed for the first time.

46. A closure as claimed in Claim 42 or Claim 43 or Claim 44, characterised in that, in use, once the ring is separated from the body of the cap by the breaking of the frangible portions and once the cap has been removed from the pouring member the ring is freely

removable from the pouring member.

47. A closure as claimed in Claim 45, characterised in that the screw cap has an internal annular chamfered surface around its rim against which an external annular chamfered surface of the ring is located.

48. A closure as claimed in Claim 47, characterised in that the pouring member has a series of breaking teeth on its outer periphery whose purpose is, during assembly of the closure, to break the frangible portions of the ring, separating it into several parts.

49. A closure as claimed in Claim 48, characterised in that the pourer has an external annular abutment ridge on whose upper surface the said teeth are moulded and against which the said portions of the ring are retained.

50. A closure as claimed in any one of Claims 3, 4 or 48, characterised in that the ring has a lower annular portion which is retained between the lower end of the screw cap and an upwardly directed annular surface of the pouring member.

51. A closure as claimed in Claim 3, characterised in that the ring comprises an upper and a lower annular member connected together by frangible portions.

52. A closure as claimed in Claim 51,

characterised in that the screw cap has an internal annular chamfered surface around its rim which carries a series of grooves.

53. A closure as claimed in Claim 52, characterised in that the upper member of the ring has an external annular chamfered surface which carries a series of grooves which engage the grooves on the cap, whereby, in use, the ring is caused to turn with the cap.

54. A closure as claimed in Claim 53, characterised in that the lower member of the ring carries a series of teeth each tooth having a surface inclined to the axis and an axially extending surface, and in that the pourer includes a corresponding series of teeth whereby, during assembly, the inclined surfaces of the respective series of teeth may slide over each other when the cap is screwed onto the pourer but, in use, when the cap is unscrewed the inter-engagement of the axially extending surfaces prevents the ring from turning with respect to the pouring member, causing the frangible portions to break.

55. A closure as claimed in Claim 54, characterised in that the toothed lower annular member is retained between the lower end of the screw cap and a radially outwardly extending surface of the pouring member.

56. A closure as claimed in any one of the preceding claims, characterised in that the component parts of the closure are retained together without the

use of adhesives.

57. A closure as claimed in Claim 56 in which all the component parts are retained together by screw connections or snap-fitting connections.

58. A combination of a bottle and a closure as claimed in any one of the preceding claims.

59. A bottle and closure as claimed in Claim 58, characterised in that the bottle has a series of axially aligned ribs around the periphery of its neck.

60. A closure substantially as herein specifically described with reference to Figures 1 to 14, Figures 15 to 21, Figures 22 to 24, Figures 25 to 29, Figures 30 to 35 and 37 to 39 or to Figures 36 to 42 and Figures 31 and 32.

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Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

10 JANUARY 1992

Documents considered relevant following a search in respect of claims 1-60

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
Y	GB 2219570 A (GRUPO STEVI SA) see Figure 1	1-60
X Y	GB 2158424 A (ANGELO GUALA SPA) see Figure 1 and page 2 lines 67-117	1,2,3, 26,35, 36,45, 11 & 12
Y	GB 2136408 A (MASSMOULD HOLDINGS LTD) see Figure 1 and 4	25,35,36 42 & 43
Y	EP 0014319 A (BAUER ROLAND) see Figure 1	3,35,36 & 42
X	US 4497415 A (ADRIANO G AROWA DELONGHI) see Figures 1 and 2	1,2,4-10, 14-19,21 -24,28-34 37-40,46, 56-59,3, 11,12,25, 26,35,36, 42 & 43

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